Anritsu

ME3401A

Digital Transmission Analyzer

Operation Manual

Read this manual before using the equipment.
Keep this manual with the equipment.

ME3401A

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Operation Manual

Second Edition

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Measuring Instruments Division
Measurement Group

ANRITSU CORPORATION

MAY
1996

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Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols BEFORE using the equipment.

Symbols used in manual

DANGER	This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
WARNING	This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
CAUTION	This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

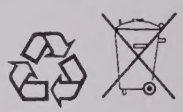
(Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.) The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.

This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.

This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

This indicates warning or caution. The contents are indicated symbolically in or near the triangle.

This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

ME3401A Digital Transmission Analyzer
Operation Manual

July 1988 (First Edition)
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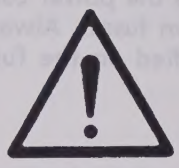
For Safety

WARNING



1. Always refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
   Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

2. When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING ⚠

3. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.

Falling Over

4. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

CAUTION

Changing Fuse

CAUTION ⚠

1. Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. Always use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.

   T□□□ A indicates a time-lag fuse.

   There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

2. Keep the power supply and cooling fan free of dust.

Cleaning

- Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
- Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, the National Research Laboratory and the Communication Research laboratory, and was found to meet the published specifications.

Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to misoperation, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding and earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

If this equipment develops a fault, contact the head office of Anritsu Corporation at the address in the operation manual, or your nearest sales or service office listed on the following pages.

(Blank)

Note :

The instrument can be used with either a dc or ac power source selected by a rear panel switch.

When using ac, items 1 to 3 below should be noted.

1. The instrument is operable on a voltage of 85 to 130 Vac or 170 to 250 Vac by changing the connections on the power transformer taps.

   The voltage and current ratings are indicated on the rear panel when the instrument is shipped from the factory.

   To operate on the other voltage, change the connections on the power supply transformer. The plate on the rear panel indicating the voltage and current ratings should be changed to the appropriate one. Order the plate from ANRITSU CORPORATION if needed.

2. In this manual, the power supply voltage and current ratings are represented by **Vac, ***A, and ****A, respectively.

3. The relationship between power supply voltage and current rating is shown below.

**Vac	***A (Transmitter)	****A (Receiver)
85 to 130 V	2 A	2 A
170 to 250 V	1.25 A	1.6 A

Fuse name is T***A 250 V or T****A 250 V, respectively.

TABLE OF CONTENTS (Continued)

		Page
3.2.3	Transmitter FUNCTION SWITCH #30 (Rear panel)	3-23
3.2.4	Receiver FUNCTION SWITCH A, B, and C #40 (Rear panel)	3-26
3.2.5	Built-in Printer (OPT11)	3-30
3.3	Measurement	3-47
3.3.1	Back-to-back check	3-47
3.3.2	Measurement preparation	3-56
3.3.3	Measurement example	3-62
SECTION 4	PRINCIPLES OF OPERATION	
4.1	Transmitter	4-1
4.2	Receiver	4-4
SECTION 5	EXPLANATION OF FUNCTIONS	
5.1	Transmitter	5-1
5.2	Receiver	5-13
SECTION 6	SELF TEST	
6.1	Connections and Settings	6-1
6.2	Procedure	6-1
6.3	Output of Test Result	6-2

TABLE OF CONTENTS (Continued)

		Page
SECTION 7	GP-IB (OPT41, 42)	
7.1	General	7-1
7.2	Specifications	7-2
7.3	GP-IB Interface Unit Installation and Removal	7-3
7.3.1	Installation	7-4
7.3.2	Removal	7-4
7.4	Preparation	7-6
7.4.1	GP-IB cable connection	7-6
7.4.2	Address setting	7-7
7.5	Operation	7-9
7.5.1	Panel setting	7-10
7.5.2	Panel setting readout	7-22
7.6	Fetching Measured Data	7-23
7.6.1	Transmitter	7-23
7.6.2	Receiver	7-24
SECTION 8	RS-232C (OPT43, 44)	
8.1	General	8-1
8.2	Functions	8-2

TABLE OF CONTENTS (Continued)

		Page
8.3	RS-232C Interface Unit Installation and Removal	8-3
8.3.1	Installation	8-4
8.3.2	Removal	8-4
8.4	Preparations	8-5
8.4.1	Setup	8-5
8.4.2	RS-232C interface rear panel setting	8-6
8.4.3	RS-232C interface internal switch setting	8-7
8.4.4	Fetching measured data	8-8
8.4.5	Controller setting	8-9
8.5	Operation	8-10
8.5.1	ME3401A panel setting	8-10
8.5.2	ME3401A panel setting read-out	8-11
SECTION 9	PERFORMANCE CHECK	
9.1	General	9-1
9.1.1	Transmitter performance check items	9-1
9.1.2	Receiver performance check items	9-2
9.2	Equipment Required for Performance Check	9-2
9.3	Preparations	9-7
9.4	Transmitter Performance Check Procedure	9-8
9.4.1	Internal clock	9-8
9.4.2	External clock	9-10

TABLE OF CONTENTS (Continued)

		Page
9.4.3	Pattern	9-14
9.4.4	Frame	9-17
9.4.5	Error addition	9-19
9.4.6	DS-3 OUTPUT	9-24
9.4.7	DS-1/DS-1C/DS-2 OUTPUT	9-30
9.4.8	Unipolar output	9-34
9.4.9	X-bit input	9-37
9.4.10	External data	9-45
9.4.11	Transmitter jitter modulation (OPT 01) ...	9-48
9.5	Receiver Performance Check Procedure	9-51
9.5.1	DS-3 Input	9-51
9.5.2	DS-1/DS-1C/DS-2 input	9-54
9.5.3	Unipolar input	9-57
9.5.4	Pattern and frame	9-59
9.5.5	Measurement	9-61
9.5.6	STATUS LED	9-65
9.5.7	Printer (OPT 11)	9-68
9.5.8	Receiver jitter measurement (OPT 02)	9-71
APPENDIX A		A-1

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SECTION 1

GENERAL

The ME3401A Digital Transmission Analyzer is error rate measuring equipment for DS-3, DS-2, DS-1C, and DS-1 transmission systems, and is ideally suited for developing and maintaining these systems.

The ME3401A can also measure the error rates of 1 Mb/s to 50 Mb/s unipolar signals.

The ME3401A consists of two instruments: a transmitter and a receiver, and the following functions can be optionally added.

1. Measured data recording

   OPT11 Built-in printer (Receiver)

2. Jitter modulation

   OPT01 Jitter modulation (Transmitter)

3. Jitter measurement

   OPT02 Jitter measurement (Receiver)

4. External control

   OPT41 GP-IB (Transmitter)
   OPT42 GP-IB (Receiver)
   OPT43 RS-232C (Transmitter)
   OPT44 RS-232C (Receiver)

SECTION 2

COMPOSITION AND SPECIFICATIONS

2.1 Composition

2.1.1 Standard composition

Table 2-1 lists the standard composition of the ME3401A Digital Transmission Analyzer.

Table 2-1 Standard Composition

Item		Name	Qty.	Remarks
Transmitter	Instrument	ME3401A Digital Transmission Analyzer Transmitter	1	
	Accessories	Power cord	1	
		Fuse	1 set	T***A250V --- 2 MF51NN250V5ADC01 --- 2 MF51NN250V2ADC01 --- 1 MF51NN250V1ADC01 --- 1 MF51NN250V0.5ADC01 -- 1
Receiver	Instrument	ME3401A Digital Transmission Analyzer Receiver	1	
	Accessories	Power cord	1	
		Fuse	1 set	T****A250V --- 2 MF51NN250V6.3ADC01 -- 1 MF51NN250V5ADC01 --- 1 MF51NN250V2ADC01 --- 1 MF51NN250V1.6ADC01 -- 1 MF51NN250V1ADC01 --- 2
Transmitter Receiver	Accessories	Operation manual	1	
		Service manual	1	

2.1.2 Options, optional accessories, and peripheral devices

(1) Options

Table 2-2 lists the options for the ME3401A.

Table 2-2 Options

Option No.	Name	Remarks
01	Jitter modulation function	For transmitter
02	Jitter measuring function	For receiver
03	DS-1 OUTPUT (BIPOLAR)	DS-1 output is changed from unipolar to bipolar (for receiver). See APPENDIX A
11	Built-in printer	For receiver
41	GP-IB interface	For transmitter*
42	GP-IB interface	For receiver*
43	RS-232C interface	For transmitter*
44	RS-232C interface	For receiver*
45	Weco 477 type jack	For transmitter/receiver DS-3 output/input
46	Weco 560A type jack	For transmitter/receiver DS-3 output/input
47	Stacking foot	Foot for stacking and securing the receiver on top of the transmitter
48	Stacking foot	Either the transmitter or receiver is stackable

*: For transmitter, either OPT41 or OPT43 can be mounted.
For receiver, either OPT42 or OPT44 can be mounted.

(2) Optional accessories

Table 2-3 lists the optional accessories for the ME3401A.

Table 2-3 Optional Accessories

Model No./ Order No.	Name	Remarks
J0126B	BNC cable	BNC [ ] —— 2m —— [ ] BNC
J0070	Weco 440A cable	Weco 440A type [ ] —— 2m —— [ ] Weco 440A type
	Weco 358 cable	Weco 358 type [ ] —— 2m —— [ ] Weco 358 type
	Weco 440A-BNC cable	Weco 440A type [ ] —— 2m —— [ ] BNC
J0071	Weco 440A - Weco 358 cable	Weco 440A type [ ] —— 2m —— [ ] Weco 358 type
J0066	Weco 440A/BNC adapter	Weco 440A type plug/BNC jack
J0167B	Balanced cable	Weco 310 type [ ] —— 2m —— [ ] Weco 310 type
J0008	GP-IB cable	2 m
J0019A	Modem cable	2 m
Z0031B	Printer paper	TP50KS
B0042	Rack mount kit	
B0286D	Soft case for transmitter	
B0286D	Soft case for receiver	
B0286F	Carrying case A for transmitter	
B0286F	Carrying case A for receiver	
B0286E	Carrying case B for transmitter	With built-in soft case
B0286E	Carrying case B for receiver	With built-in soft case
B0019	Protective cover	For instrument transportation

(3) Peripheral device

Table 2-4 lists the peripheral devices for the ME3401A.

Table 2-4 Peripheral Devices

Name	Remarks
Personal Technical Computer Packet III	Controller
Portable Test Rack MB23A	The table can be tilted.
Portable Test Rack MB24A	The table is fixed in a horizontal position.

2.2 Specifications

2.2.1 Transmitter

Table 2-5 lists the specifications of the ME3401A Transmitter.

Table 2-5 ME3401A Transmitter Specifications

Clock	Internal	Frequency	DS-3: 44.736 MHz DS-2: 6.312 MHz DS-1C: 3.152 MHz DS-1: 1.544 MHz
		Accuracy	Within ±10 ppm
	External	Frequency range	DS-3 : 1 to 50 MHz DS-2 : 1 to 10 MHz DS-1C: 1 to 10 MHz DS-1 : 1 to 10 MHz
		Input level and waveform	TTL: Square wave (High: +2.4 to +5 V, Low: -0.2 to +0.4 V) 0.7 to 1.5 Vp-p: Sine wave and square wave ECL: Square wave
		Impedance	75 Ω
		Termination	TTL, 0.7 to 1.5 Vp-p: GND ECL: nominal -1.3 V
		Connector	BNC
Pattern	Pseudorandom (PRBS)		DS-3: PRBS $2^{15}-1$*, PRBS $2^{23}-1$* * Conforms to CCITT Rec. O.151. DS-2: PRBS $2^{20}-1$ DS-1C: PRBS $2^{20}-1$ (With 14-zero constraint) DS-1: PRBS $2^{20}-1$ (With 14-zero constraint)
	Fixed	1111, 1100, 1010, 1000	
	External	Input level	ECL: "1" -0.89 ±0.12 V "0" -1.75 ±0.12 V TTL: "1" +2.4 V to +5 V "0" -0.2 V to +0.4 V
		Impedance	75 Ω
		Terminal	TTL: GND ECL: nominal -1.3 V
		Connector	BNC

Table 2-5 ME3401A Transmitter Specifications (continued)

Frame			DS-3, DS-2, DS-1C, and DS-1 (D4, ESF) frames conform to Bell Standards. The frames can be set to ON or OFF.
Bipolar output	DS-3	Code	B3ZS, AMI (The AMI can only be set for a 1000 pattern.)
		Waveform, level	DS-3 High Amplitude: 0.91 Vo-p ±0.1 V Pulse width: 11.2 ±1.1 ns (at half amplitude) (internal clock) Rise/fall time: 4.5 ±1.5 ns Overshoot/undershoot: ≦10% of amplitude DSX-3 High output in series with equivalent of 450 ft of 728A cable (Fig. 2-3) DS-3 Low CH1 to CH5: 0.186 Vo-p nominal (13.8 dB lower than high level) CH6: High output connected in series with equivalent of 900 ft of 728A cable
		No. of outputs	6
		Phase	3 bits delayed for each of the six output phases in order from 1 to 6
		Load	75 Ω unbalanced
		Connector	BNC
	DS-2	Code	B6ZS
		Waveform, level	DS-2 High Amplitude: 2.1 Vo-p ±0.25 V Pulse width: 79 ±10 ns DSX-2 High output in series with an equivalent of 1000 ft of ABAM cable (Fig. 2-2)
		No. of output	1 (same output connector is used with DS-2, DS-1C, and DS-1)
		Load	110 Ω balanced
		Connector	Compatible with Weco 310 type plug

Table 2-5 ME3401A Transmitter Specifications (continued)

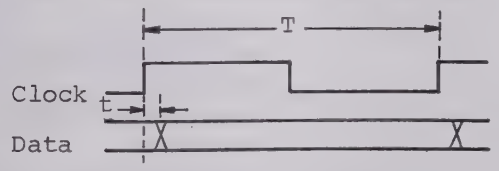
Bipolar output (cont'd)	DS-1C	Code	AMI
		Waveform, level	Amplitude: 3 Vo-p ±0.3 V Pulse width: 159 ±20 ns
		No. of output	1 (same output connector is used with DS-2, DS-1C, and DS-1)
		Load	100 Ω balanced
		Connector	Accepts Weco 310 plug
	DS-1	Code	AMI, B8ZS
		Waveform, level	Amplitude: nominal 3 Vo-p Waveform: Fig. 2-1
		No. of output	1 (same output connector is used with DS-2, DS-1C, and DS-1)
		Load	100 Ω balanced
		Connector	Accepts Weco 310 plug
Unipolar output	Clock/ Data	Frequency	1 MHz to 50 MHz
		Waveform	Clock: RZ (Duty: 40% to 60%) Data: NRZ
		Level	TTL: "1" +2.4 to +5 V "0" -0.2 to +0.4 V +1/-1V: "1" +1 ±0.1 V "0" -1 ±0.1 V ECL: "1" -0.89 ±0.12 V "0" -1.75 ±0.12 V
	Phase		 |t| < (10% of T) + 1 ns
	No. of outputs		Clock: 1, Data: 1
	Load		TTL, +1/-1 V: GND through 75 Ω ECL: Nominal -2 V through 75 Ω
	Connector		BNC

Table 2-5 ME3401A Transmitter Specifications (continued)

Error addition	Error		Bit error, frame error, parity error (DS-3), CRC-6 error (DS-1 ESF)
	Internal		10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}, 10^{-9}, Single error
	External	Error	Single (one error at each fall time) Burst (when external signal is low level, errors are added)
		Pulse width	$\geqq$200 ns and $\geqq$10 bits
		Interface	TTL
		Connector	BNC
Other I/O	X-bit input	Signal	Sets X-bit for DS-3, DS-2, or DS-1C frame
		Interface	TTL Input level High: "1" Low: "0"
		Connector	BNC
	Clock sync output	Level	TTL
		Impedance	75 Ω
		Connector	BNC
	Pattern sync output	One period	Pseudorandom pattern: 2 pseudorandom pattern periods Fixed pattern: 8 bits
		Level	TTL
		Impedance	75 Ω
		Connector	BNC
	Frame sync output	One period	1 multiframe
		Interface	TTL
		Connector	BNC

Table 2-5 ME3401A Transmitter Specifications (continued)

Remote control (option)	Interface	GP-IB (OPT41, conforms to IEEE Std. 488-1978) RS-232C (OPT43)
	Control	Panel setting and jitter amplitude data output
Power supply	AC	85 to 130 V or 170 to 250 V, 48 to 63 Hz, ≦100 VA
	DC	-22 to -53 V, ≦3 A
Dimensions and weight		133H x 426W x 370D mm, <12 kg
Ambient temperature, rated range of use		0° to 50°C

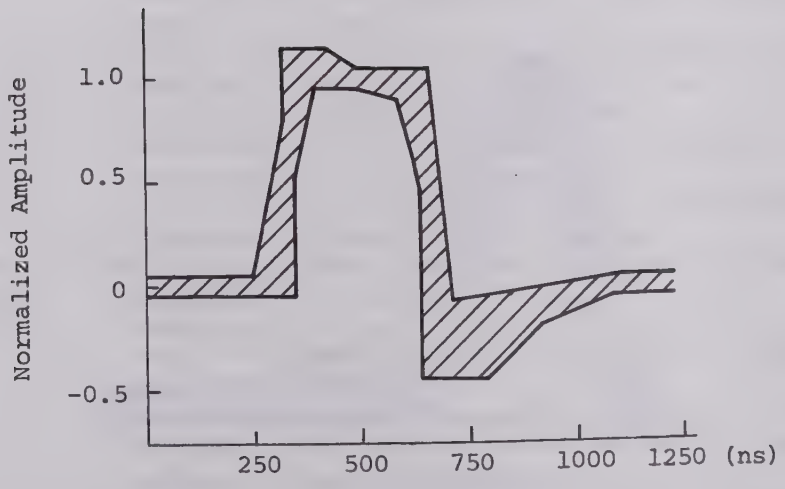


Fig. 2-1 DS-1 Pulse Mask

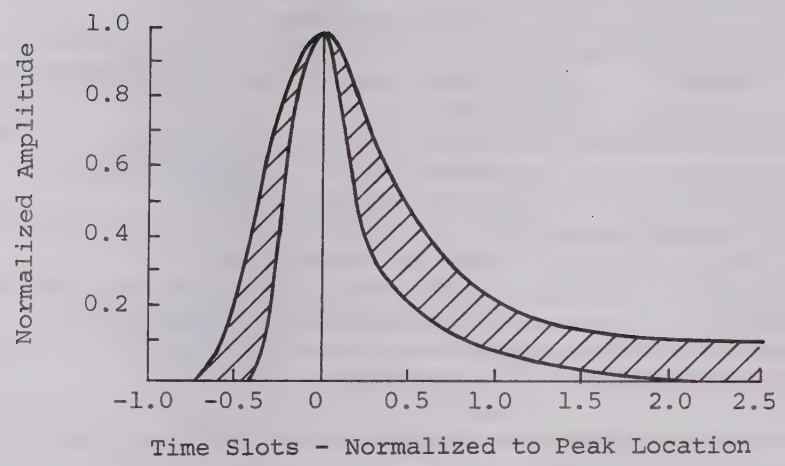


Fig. 2-2 DSX-2 Pulse Mask

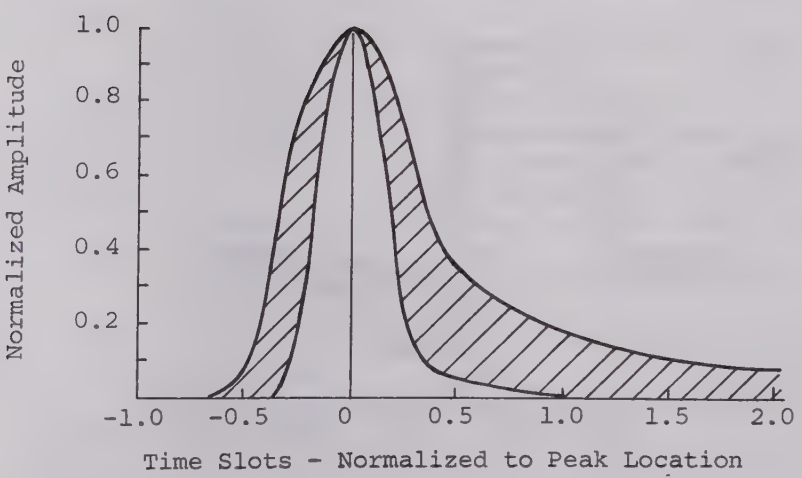


Fig. 2-3 DSX-3 Pulse Mask

2.2.2 Receiver

Table 2-6 lists the specifications of the ME3401A Receiver.

Table 2-6 ME3401A Receiver Specifications

Bipolar input	DS-3	Operating frequency	44.736 MHz ±4.4 kHz
		Code	B3ZS
		Waveform, level	DS-3 H/L: 0.91 Vo-p, +6 to -26 dB DSX-3 H/L: 0.91 Vo-p, +6 to -26 dB and 450 ft of 728A cable or 0.91 Vo-p, +6 to -6 dB and 450 to 900 ft of 728A cable
		Impedance	75 Ω unbalanced
		Connector	BNC Weco 440A or Weco 358A plug acceptable connector optionally available
	DS-2	Operating frequency	6.312 MHz ±630 Hz
		Code	B6ZS
		Waveform, level	2.1 Vo-p, +2 to -6 dB and 0 to 1000 ft of ABAM cable
		Impedance	110 Ω balanced
		Connector	Accepts Weco 310 plug
	DS-1C	Operating frequency	3.152 MHz ±310 Hz
		Code	AMI
		Waveform, level	3 Vo-p, +2 to -6 dB, and 0 to 655 ft of ABAM cable
		Impedance	100 Ω balanced
		Connector	Accepts Weco 310 plug

Table 2-6 ME3401A Receiver Specifications (continued)

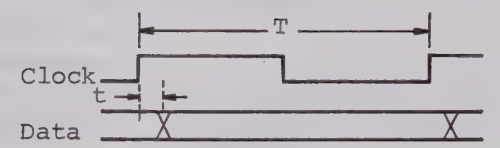
Bipolar input (cont'd)	DS-1	Operating frequency	1.544 MHz ±250 Hz
		Code	AMI, B8ZS
		Waveform, level	3 Vo-p, +2 to -6 dB and 0 to 655 ft of ABAM cable
		Impedance	100 Ω balanced
		Connector	Accepts Weco 310 plug
Unipolar input	Clock, Data	Frequency	1 to 50 MHz
		Level	TTL: "1" +2.4 to +5.0 V "0" -0.2 to +0.4 V +1/-1 V: "1" +1 ±0.1 V "0" -1 ±0.1 V ECL: "1" -0.89 ±0.12 V "0" -1.75 ±0.12 V
		Phase	 |t| < (10% of T) + 1 ns
		Termination	TTL, +1/-1 V: GND through 75 Ω ECL: GND through 100 Ω and -5.2 V through 300 Ω
		Connector	BNC
Pattern	Pseudorandom		DS-3: PRBS $2^{\overline{15}}-1^{*}$, PRBS $2^{\overline{23}}-1^{*}$ * Conforms to CCITT Rec. O.151 DS-2: PRBS $2^{20}-1$ DS-1C: PRBS $2^{20}-1$ (With 14-zero constraint) DS-1: PRBS $2^{20}-1$ (With 14-zero constraint)
	Fixed		1111, 1100, 1010, 1000
	LIVE		Skips the bit error measurement

Table 2-6 ME3401A Receiver Specifications (continued)

Frame			The DS-3, DS-2, DS-1C, and DS-1 (D4, ESF) frames conform to Bell standards. The frames can be set to ON or OFF.
DEMUX			An arbitrary DS-1 channel signal (CH1 to CH28) can be picked up out of the DS-3 signal and error measurement can be performed for the picked up signal.
Measurement	Error detection	Bit	Error detected by bit-by-bit comparison
		Parity	Error detected by comparing input data parity bit with parity calculated from input data
		Frame	Frame bit error
		Bipolar	Code rule error
		CRC-6	Error detected by comparing CRC data of input data with CRC data calculated from input data
		Error inhibit	Errors can be inhibited approx. one second before and after there is no input or frame signal. This function is effective only when error second is set to ASYNC.
	Measurement items and measuring range	Error rate	9.9×10^{-2} to 1.0×10^{-15}
		Error count	0 to 99999, 1×10^{5} to 9.9×10^{15}
		Error seconds	0 to 99999, 1×10^{5} to 9.9×10^{9} ASYNC and SYNC selectable
		%Error free seconds	0.0000% to 100%
		Threshold error seconds	0 to 99999, 1×10^{5} to 9.9×10^{9} Threshold values: Error rate: 10^{-3} to 10^{-7} Error count: 1, 5, 10, 100, or 1000

Table 2-6 ME3401A Receiver Specifications (continued)

Measure-ment (cont'd)	Error performance data	Errored seconds, errored free seconds, severely ES, degraded minutes, unavailable seconds, consecutive SES The above items are measured only when error second is set to ASYNC. The data can only be output to a printer, GP-IB or RS-232C interface.
	Measurement item combinations	For error rate, error count, error seconds, error free seconds, and threshold error seconds measurement: the items marked with x in the table below are measured at the same time.

Setting			Error				
Clock	Frame	DEMUX	Bit*1	Parity	Frame	Bipolar*2	CRC-6
DS-3	ON	OFF	x	x	x	x	-
		ON	x*3	-	x	-	x*3
	OFF		-	x	-	-	x	-
DS-2 DS-1C	ON		-	x	-	x	x	-
	OFF		-	x	-	-	x	-
DS-1	D4		-	x	-	x	x	-
	ESF		-	x	-	x	x	x
	OFF		-	x	-	-	x	-

*1 This is not measured when pattern is set to LIVE.
*2 This is not measured when a unipolar signal is input.
*3 This is a DS-1 signal error.
CRC-6 error is measured at ESF.

For error performance data measurement:
Non-LIVE pattern: Bit error
LIVE pattern: Frame error

Table 2-6 ME3401A Receiver Specifications (continued)

Measure-ment (cont'd)	LED indication	AC POWER FAIL: Lights when the instrument is recovered from power failure. SIGNAL LOSS: Lights when there are no input signals. Lights when there are no clock signals (for unipolar input). FRAME LOSS: Lights when frame synchronization is lost. The frame sync loss status is detected in the following cases. DS-3: Three or more bits out of a 15-bit frame signal are erroneous or two of three pairs of multiframe signals (010) are erroneous. DS-2, DS-1C, and DS-1: Three or more frame bits in one multiframe are erroneous or three continuous pairs of multiframe signals (DS-2 and DS-1C: 011, DS-1: 0011) are erroneous. When the [DEMUX] key is set to ON, the frame sync loss status is detected when the DS-3, DS-2, or DS-1 signal has one of the above errors. The frame sync recovery status is detected in the following cases. DS-3: Continuous 15-bit frame signals and two continuous pairs of multi-frame signals do not have errors. DS-2 and DS-1C: Continuous 8-bit frame signals and three continuous pairs of multi-frame signals do not have errors. DS-1: Continuous 10-bit frame signals and three continuous pairs of multiframe signals do not have errors. When the [DEMUX] key is set ON, the frame sync recovery status is detected when the DS-3, DS-2, and DS-1 signals satisfy the above conditions.

Table 2-6 ME3401A Receiver Specifications (continued)

Measure-ment (cont'd)	LED indication	PATTERN SY LOSS*: Lights when pattern synchronization is lost. The pattern sync loss status is detected in the following case. There are errors of approx. 10^4 bits or more in 10^5 clock bits. The pattern sync recovery status is detected in the following case. A non-error status is continued for approx. 50 bits. BLUE SIGNAL: Lights under the following conditions. DS-3: 1010 pattern is continuously received for approx. 250 bits or more. DS-2, DS-1C, and DS-1: An all ones pattern is continuously received for approx. 250 bits or more. X-BIT: Lights when the x-bit level is low. Note that the input must be DS-3, DS-2, or DS-1C. ERRORS: Lights each time an error (selected using MEASUREMENT [ERROR] key on the front panel) is detected. Note that this LED does not light if the current measurement is suspended or stopped. GATING: Remains on during measurement.
	BUZZER	The buzzer sounds when SIGNAL LOSS, FRAME LOSS, PATTERN SY LOSS, BLUE SIGNAL, or ERRORS are detected. The buzzer can be turned on or off.

Table 2-6 ME3401A Receiver Specifications (continued)

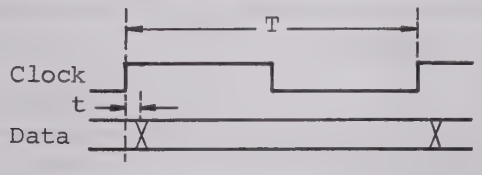
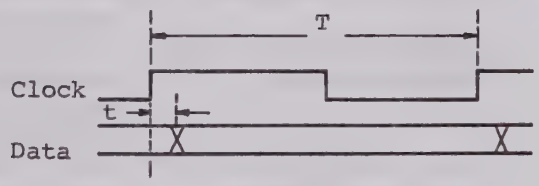
Time	Measuring time	Time	One-second increment from one second to 99 days, 23 hours, 59 minutes, and 59 seconds
		Clock count	<10 MHz: 10^6, 10^7, 10^8, 10^9 Bits ≧10 MHz: 10^7, 10^8, 10^9 Bits
		Display	The set time, remaining and elapsed measuring time can be displayed
	Measuring mode		Repeat, single, and manual (UNTIMED) modes start/stop and pause/continue functions are provided for above modes
	Real time clock	Display	Year: month: day: hour: minute: second (Year: two low-order digits only)
		Error	Within 10 s/day
Output signal	Monitor Clock Data	Level	TTL "1": +2.4 to +5 V "0": -0.2 to +0.4 V Input signal level: DSX-3: 0.91 Vo-p, +6 dB to -6 dB and 450 ft 728A cable DS-3: 0.91 Vo-p, +6 dB to -6 dB DS-2/DS-1C/DS-1: Same as Unipolar input level Unipolar: Same as Unipolar input level
		Phase	 $\|t\| \leqq$ (10% of T) + 1 ns
		Load	75 Ω
		Connector	BNC
	X-BIT	Interface	TTL
		Connector	BNC

Table 2-6 ME3401A Receiver Specifications (continued)

Output signal	Alarm	Interface	TTL Becomes high level when SIGNAL LOSS, FRAME LOSS, PATTERN SY LOSS, or BLUE SIGNAL are deleted.
		Connector	BNC
	DS-1 Clock Data	Signal	DS-1 signal extracted from DS-3 signal
		Level	TTL "1": +2.4 to +5 V "0": -0.2 to +0.4 V
		Phase	 $\|t\| \leqq$ (10% of T) + 1 ns
		Load	75 Ω
		Connector	BNC
	Error	Signal	One of the following error signals can be selected: bit, parity, frame, or bipolar error signal. When DS-1 frame signal is ESF (even when DEMUX is set ON), a CRC-6 error is output instead of a parity error.
		Level	TTL (RZ)
		Load	75 Ω
		Connector	BNC
Remote control (Option)	Interface		GP-IB (OPT42: Conforms to IEEE Std. 488-1978) RS-232C (OPT44)
	Control		Panel setting and measured data output
Power supply		AC	85 to 130 V or 170 to 250 V, 48 to 63 Hz, $\leqq$125 VA
		DC	-22 to -53 V, $\leqq$3.5 A
Dimensions and weight			133H x 426W x 370D mm, $\leqq$14 kg
Ambient temperature, rated range of use			0° to 50°C

2.2.3 Receiver built-in printer (OPT11)

Table 2-7 lists the specifications of the ME3401A Receiver built-in printer.

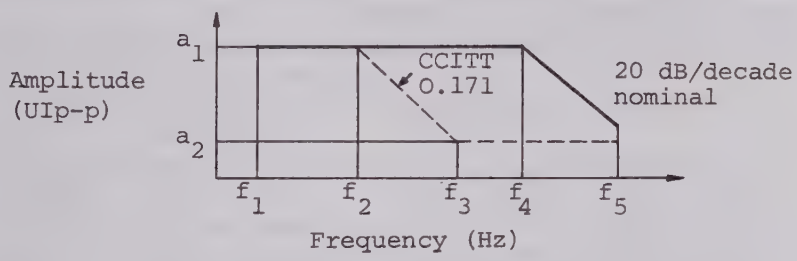
Table 2-7 ME3401A Receiver Built-in Printer Specifications

Printing method	Thermal
Printing speed	Approx. 3 lines/s (max. of 20 characters/line)
Print contents	Measured results, errors and alarm occurrence/ recovery, error performance data, and time
Manual printing	Possible

2.2.4 Transmitter jitter modulation function (OPT01)

Table 2-8 lists the specifications of the ME3401A Transmitter jitter modulation function.

Table 2-8 ME3401A Transmitter Jitter Modulation Function Specifications

Clock frequency	DS-3: 44.736 MHz DS-2: 6.312 MHz DS-1C: 3.152 MHz DS-1: 1.544 MHz
Modulation range	

	a1 (UIp-p)	a2 (UIp-p)	f1 (Hz)	f2 (kHz)	f3 (kHz)	f4 (kHz)	f5 (kHz)
DS-3	16	0.5	2	3.2	100	100	1000*
DS-2	10	0.5	2	1.6	32	40	160
DS-1C	10	0.5	2	-	-	20	80
DS-1	10	0.5	2	0.2	4	10	40

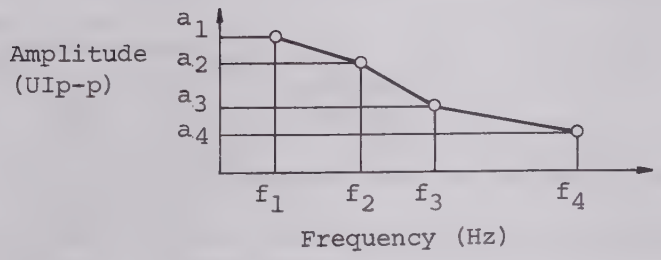
* 4500 kHz in CCITT

Fig. 2-4 Amplitude/Frequency

Accuracy	±5% ±0.1 UIp-p
Display	DS-3: 0.00 to 16.2 DS-2, DS-1C, DS-1: 0.00 to 10.2 Other than above values: OFL

Table 2-8 ME3401A Transmitter Jitter Modulation Function Specifications (continued)

Modulation signal	Internal	Frequency: 2 Hz, 10 Hz, 60 Hz, 350 Hz, 500 Hz, 900 Hz, 1, 2.3, 2.5, 3, 4, 8, 10, 15, 20, 40, 60, 80, 100, 160, 200, 300 kHz Accuracy: ±0.1% Amplitude: Within the range shown in Fig. 2-4. Step: Approx. 0.05 UIp-p (≦5 UIp-p) Approx. 0.1 UIp-p (>5 UIp-p)
	External	Frequency range: 2 Hz to 1 MHz Amplitude: Within the range shown in Fig. 2-4. Waveform: Sine wave Sensitivity: Approx. 4 UIp-p/1 Vp-p Impedance: 75 Ω Connector: BNC
Auto sweep		Frequency sweep is done automatically at four points. Sweep order: f1 → f2 → f3 → f4 → f3 → ... An arbitrary frequency (≧10 Hz) and amplitude can be programmed.



Initial value

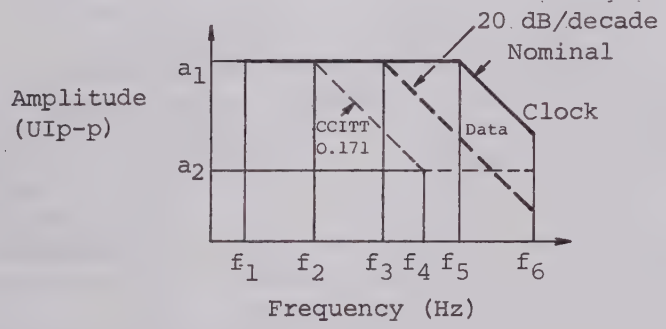
	A1,A2 (UIp-p)	A3,A4 (UIp-p)	f1 (Hz)	f2 (Hz)	f3 (kHz)	f4 (kHz)
DS-3	5.3	0.15	10	2300	60	300
DS-2	5.3	0.15	10	900	4	20
DS-1C	5.3	0.15	10	60	3	40
DS-1	5.3	0.15	10	500	8	40

* A1, A2, A3, and A4 are typical values.

2.2.5 Receiver jitter measurement function (OPT02)

Table 2-9 lists the specifications of the ME3401A Receiver jitter measurement function.

Table 2-9 ME3401A Receiver Jitter Measurement Function Specifications

Clock frequency	DS-3: 44.736 MHz DS-2: 6.312 MHz DS-1C: 3.152 MHz DS-1: 1.544 MHz
Input level	The input level ranges for jitter measurement are as follows: DS-3: 0.91 Vo-p, +6 to -6 dB DSX-3: 0.91 Vo-p, +6 to -6 dB and 450 ft of 728A cable DS-2: 2.1 Vo-p, +2 to -6 dB and 0 to 1000 ft of ABAM cable DS-1C and DS-1: 3 Vo-p, +2 to -6 dB and 0 to 655 ft of ABAM cable
Display	0.001 UIp-p step increment (<1 UI) 0.01 UIp-p step increment (≥1 UI)
Measuring range	

	a1 (UIp-p)	a2 (UIp-p)	f1 (Hz)	f2 (kHz)	f3 (kHz)	f4 (kHz)	f5 (kHz)	f6 (kHz)
DS-3	16	0.5	10	3.2	50	100	100	1000*
DS-2	10	0.5	10	1.6	8	32	40	160
DS-1C	10	0.5	10	-	1.5	-	20	80
DS-1	10	0.3	10	0.2	0.8	7	10	40

* 4500 kHz in CCITT

Amplitude/Frequency

Table 2-9 ME3401A Receiver Jitter Measurement Function Specifications (continued)

Accuracy

±5% ±0.05 UIp-p (<1 UI)
±5% ±0.1 UIp-p (≧1 UI)

Filter

	High-pass filter 1 (Hz)	High pass filter 2 (kHz)	Low pass filter (kHz)
DS-3	10	30	400
DS-2	10	3	60
DS-1C	10	1.5	40
DS-1	10	8	40

Operation mode:

Mode	OFF	Low pass filter	Low pass filter and high pass filter 1	Low pass filter and high pass filter 2
Characteristics	No filter			

The filter characteristic is approx. 20 dB/decade.

Demodulation output

Level	Approx. 1 Vp-p/4 bits
Load	75 Ω
Connector	BNC

Receiver immunity (no error was caused) against input jitter

	UIp-p	Modulation signal frequency (kHz)
DS-3	16	4
DS-2	10	2
DS-1C	10	0.5
DS-1	10	0.2

SECTION 3

OPERATION

3.1 Precautions

3.1.1 Operating and storage conditions

This instrument is designed to operate normally in an ambient temperature range of 0° to 50°C. For best operation, however, it should be used at normal room temperature whenever possible. Do not use or store it where:

1. vibrations are severe.
2. it is damp or dusty.
3. there is exposure to direct sunlight.
4. there is exposure to strong magnetic fields.
5. oxidation or rusting may occur.

The instrument should be stored in a temperature range of 0° to 55°C, and a humidity range of 40% to 80%. It should be cleaned before storage. The storage area should not be subject to large fluctuations in temperature over a 24-hour period.

If this instrument is operated at room temperature after being used or stored for a long period at low temperatures, condensation may occur and cause short-circuiting. To prevent this do not turn the power on until the instrument is completely dry.

CAUTION

Make sure that the ME3401A air inlet and air outlet do not get plugged. (A hole in the bottom front and a fan in the rear help pass out air.)

If the air in/out flow is insufficient, the temperature in the ME3401A will rise, leading to a possible breakdown.

3.1.2 Power requirement

The ME3401A operates normally at 85 to 130 Vac or 170 to 250 Vac, 48 to 63 Hz. The transmitter (with OPT01 and OPT41 or OPT43) power consumption is $\leqq$100 VA and the receiver (with OPT02, OPT11, and OPT42 or OPT44) is $\leqq$125 VA.

The ME3401A also operates normally using -22 to -53 Vdc. When using a -48 Vdc power source, the load current is approx. 3 A in the transmitter (with OPT01 and OPT41 or OPT43) and 3.5 A in the receiver (with OPT02, OPT11, and OPT42 or OPT44).

CAUTION

When switching the power supply from ac to dc or vice versa, be sure to turn off the power switch first.

WARNING

- To prevent possible shock, be sure to connect the ⏚ terminal on the rear panel.
- Before changing a fuse, be sure to turn off the power switch and disconnect the power cord from the ac outlet.

3.1.3 Connection of device to be measured

CAUTION

Before connecting the device to be measured and the ME3401A, be sure to verify that the status of the ME3401A input/output level setting is suitable for the input/output conditions of the device to be measured. When the status is unsuitable, for example, if the ME3401A outputs unipolar signals at TTL level and the device to be measured receives them at ECL level, the device may be damaged.

3.1.4 Memory back-up

Even when the power is turned off, the ME3401A memorizes the panel set status and measured data.

The ME3401A uses rechargeable graphite fluoride primary batteries for the memory back-up. This back-up functions for approx. 7 years. If the battery becomes run-down or damaged, contact ANRITSU or your nearest representative.

Normally a worn-out battery will not affect measurement.

3.1.5 Packaging

A protective cover and carrying case (or soft case) is recommended.

3.2 Explanation of Controls

Figures 3-1 and 3-2 shows the control layout and Tables 3-1 and 3-2 list the functions.

3.2.1 Transmitter

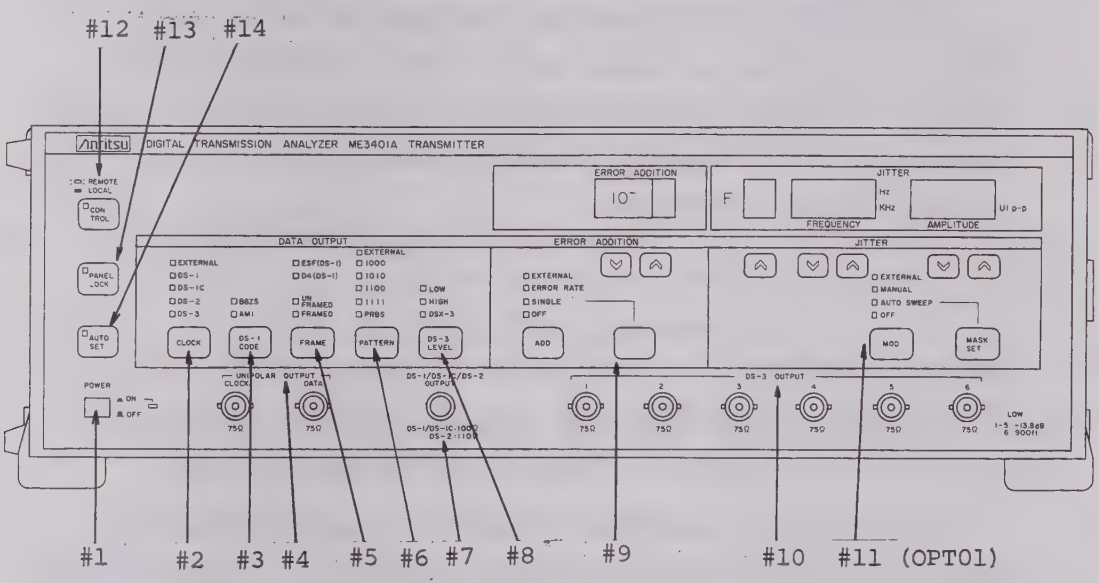


Fig. 3-1 Transmitter Front Panel

Table 3-1 Explanation of Controls (Transmitter Front Panel)

No.	Label	Function	Refer to (Paragraph)
#1	POWER	Turns the power ON or OFF	
#2	CLOCK	Selects a clock signal DS-3: 44.736 MHz DS-2: 6.312 MHz DS-1C: 3.152 MHz DS-1: 1.544 MHz EXTERNAL: An external clock signal is added For the EXTERNAL clock, set the mode using FUNCTION SWITCH (A1, A2) #30 on the rear panel because the frame and PRBS pattern vary according to the clock signal.	

Table 3-1 Explanation of Controls (Transmitter Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#2 (cont'd)	CLOCK		

CLOCK	PRBS	FRAME	BIPOLAR CODE
DS-3	$2^{15}-1$ or $2^{23}-1$ Selected using FUNCTION SWITCH (A3) #30 on rear panel	DS-3 FRAME	B3ZS When the pattern is 1000, the bipolar code can be set to AMI using FUNCTION SWITCH (A4) #30 on the rear panel.
DS-2	$2^{20}-1$	DS-2 FRAME	B6ZS
DS-1C	$2^{20}-1$ (with 14-zero constraint)	DS-1C FRAME	AMI
DS-1	$2^{20}-1$ (with 14-zero constraint)	D4 or ESF Selected using the [FRAME] key #5	AMI or B8ZS Selected using the [DS-1 CODE] key #3
EX-TERNAL	Selected using FUNCTION SWITCH (A1, A2) #30 on rear panel.		

#3	DS-1 CODE	Sets the DS-1 code The following codes are set automatically for other than DS-1: DS-3: B3ZS* DS-2: B6ZS DS-1C: AMI *: When PATTERN is set to 1000, AMI can be set using FUNCTION SWITCH (A4) #30 on the rear panel.	5.1 (2)

Table 3-1 Explanation of Controls (Transmitter Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#4	UNIPOLAR OUTPUT	Outputs unipolar signals The output level is set using UNIPOLAR OUTPUT LEVEL switch #29 on the rear panel.	5.1 (7)
#5	FRAME	Turns the frame ON or OFF For the DS-1 clock, select D4 or ESF.	5.1 (3)
#6	PATTERN	Selects a pattern For the EXTERNAL clock, set [CLOCK] key #2 to EXTERNAL, and supply an external clock and data signals to the EXTERNAL CLOCK INPUT connector #27 and EXTERNAL DATA INPUT connector #28 on the rear panel. Because no frame bits are added to external data, all LEDs above the [FRAME] key #3 go off. Errors can be added or jitters can be applied to the external data. The PRBS contents are as follows: DS-3: 2^{15}-1 or 2^{23}-1 (according to the FUNCTION SWITCH (A3) #30 setting) DS-2: 2^{20}-1 DS-1C/DS-1: 2^{20}-1 (with 14-zero constraint)	5.1 (4)
#7	DS-1/DS-1C/ DS-2 OUTPUT	DS-1/DS-1C/DS-2 signal output connector For the DS-2 signal, the output level is set to DS-2 or DSX-2 using FUNCTION SWITCH (A5) #30 on the rear panel.	
#8	DS-3 LEVEL	Sets the output level of DS-3	5.1 (6)

Table 3-1 Explanation of Controls (Transmitter Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#9	ERROR ADDITION	Adds errors to patterns. The error addition mode can be selected from EXTERNAL, ERROR RATE, SINGLE, and OFF by using the [ADD] key. This function can add bit errors, frame errors, parity errors, and CRC-6 errors. In the SINGLE mode, an error can be added each time the key at the right of the [ADD] key is pressed. In the EXTERNAL mode, apply an external signal to EXT ERROR INPUT connector #23 on the rear panel. By using FUNCTION SWITCH (A6) #30, the SINGLE mode (for adding one error each time the external signal falls) or the BURST mode (for adding errors during a low external signal level) can be selected.	5.1 (5)
#10	DS-3 OUTPUT	Outputs DS-3 signals The outputs are delayed by 3 bits each, in order from 1 to 6. Output 6 is equal to the DS-3 Low output in series with equivalent of 900 ft of 728A cable.	5.1 (6)
#11	JITTER (OPT01)	Applies jitter modulation to patterns and clock signals The jitter modulation mode can be selected from AUTO SWEEP, MANUAL, EXTERNAL, and OFF by using the [MOD] key. If this option is not mounted, the display is always off. The AUTO SWEEP mode is used to automatically measure the jitter immunity of a device to be measured according to the jitter mask setting.	

Table 3-1 Explanation of Controls (Transmitter Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#11 (cont'd)		When the AUTO SWEEP mode is set, the modulation signal frequency and jitter amplitude are changed automatically. In the MANUAL mode, an arbitrary modulation signal frequency and jitter amplitude can be set. Press the FREQUENCY and AMPLITUDE [⩓] or [⩔] key for about one second to automatically increment or decrement the frequency or amplitude value. For the EXTERNAL mode, supply a modulation signal to the JITTER MOD INPUT connector #24 on the rear panel. . AUTO SWEEP MASK change method 1. Set the mode to AUTO SWEEP. 2. Press the [MASK SET] key. The F display will start blinking. 3. Display the F number to be changed. 4. Set the frequency and amplitude. 5. If there is another F number to be changed, repeat steps 3 and 4. 6. Press the [MASK SET] key again.	
#12	CONTROL	The key LED remains on when this instrument is under GP-IB or RS-232C control. Press the key to change the mode from REMOTE to LOCAL. To initialize the instrument, turn on the POWER switch #1 while pressing this key.	
#13	PANEL LOCK	Turn on this key (key LED ON) to make all keys ineffective (except the POWER switch #1)	

Table 3-1 Explanation of Controls (Transmitter Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#14	AUTO SET	Turning on this key (key LED ON) sets the instrument into pre-programmed status and makes all keys ineffective (except the [AUTO SET], POWER switch #1, and [CLOCK] key #2, [MASK SET] key #11) . AUTO SET status change method 1. Turn on the [AUTO SET] key (key LED ON) while pressing [CONTROL] key #12. Now the panel keys are ready to be set. 2. Set the panel keys into the required status. 3. Turn off the [AUTO SET] key. The changed contents are set each time the [AUTO SET] key is turned on.	

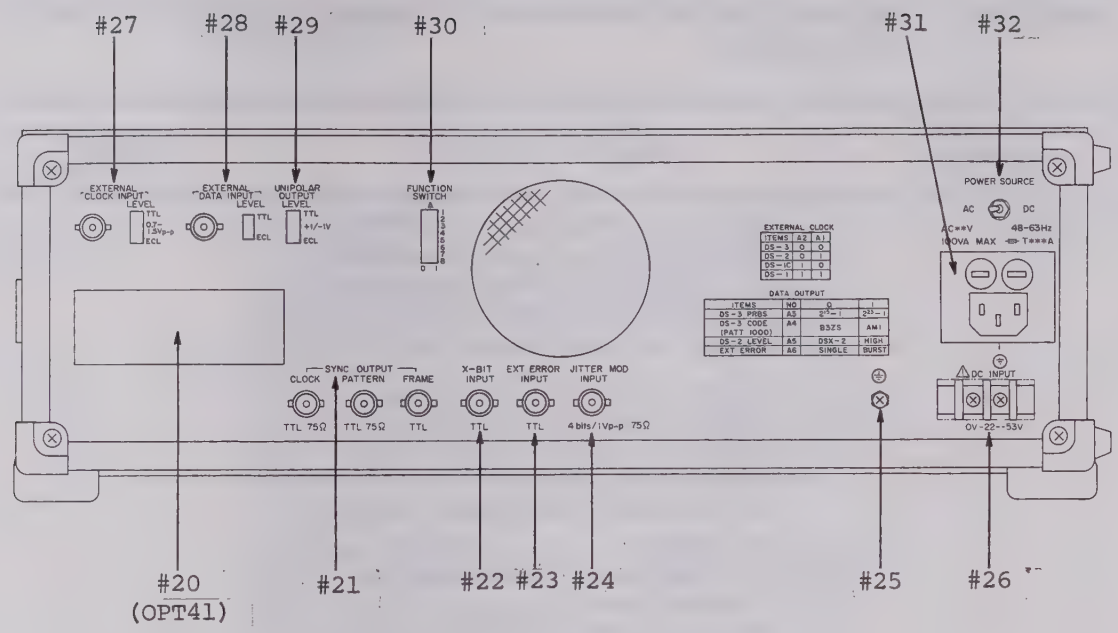


Fig. 3-2 Transmitter Rear Panel

Table 3-2 Explanation of Controls (Transmitter Rear Panel)

No.	Label	Function	Refer to (Paragraph)
#15 to #19	Not assigned		
#20	(OPT41 or OPT43)	GP-IB interface or RS-232C interface The RS-232C interface can be mounted here instead of the GP-IB.	Section 7 Section 8
#21	SYNC OUTPUT	Outputs synchronous signals Even when the jitter modulation function (OPT01) is mounted, a clock signal is output without jitter modulation.	
#22	X-BIT INPUT	X-bit modification signal input connector This signal can change the X-bit values in the DS-3, DS-2, and DS-1C frames.	5.1 (3)

Table 3-2 Explanation of Controls (Transmitter Rear Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#23	EXT ERROR INPUT	External error input connector	5.1 (5)
#24	JITTER MOD INPUT	Jitter modulation signal input connector	
#25	⏚	Ground terminal	
#26	DC INPUT	Dc power source input terminal	
#27	EXTERNAL CLOCK INPUT	External clock signal input connector When the external signal is a sin wave, select the input level 0.7 to 1.5 Vp-p.	
#28	EXTERNAL DATA INPUT	External data input connector	
#29	UNIPOLAR OUTPUT LEVEL	Sets the unipolar signal output level	
#30	FUNCTION SWITCH A	Sets additional functions The functions and settings are printed on the rear panel.	3.2.3
#31	AC**V	Ac inlet with fuse holder	
#32	POWER SOURCE	Switches the power source from ac to dc or vice versa When using the switch, be sure to turn off the POWER switch #1 first.	

3.2.2 Receiver

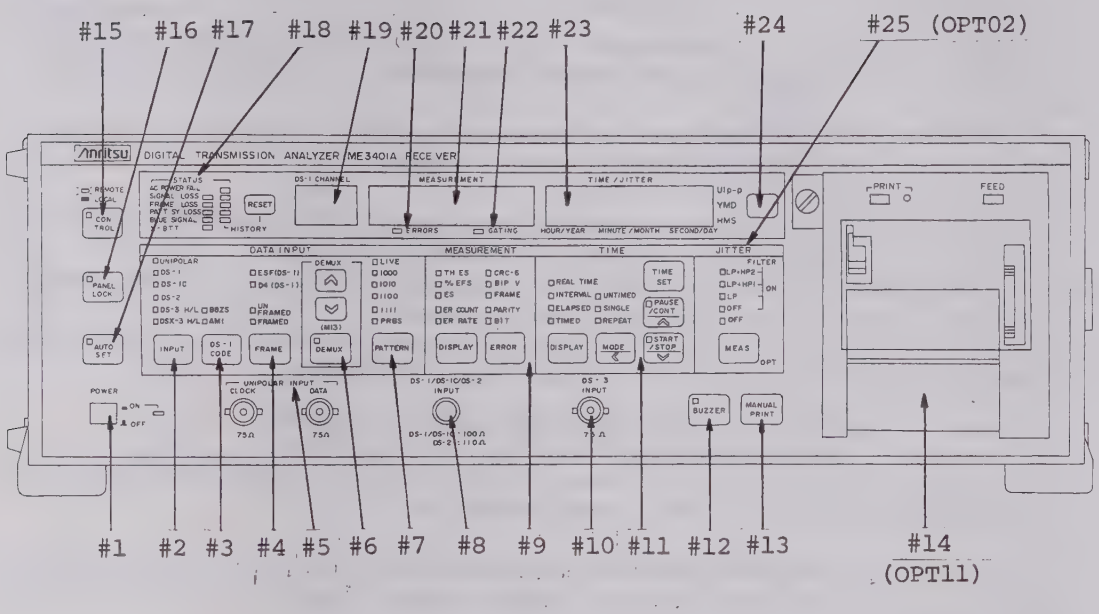

#15 #16 #17 #18 #19 #20 #21 #22 #23 #24 #25 (OPT02)
Anritsu DIGITAL TRANSMISSION ANALYZER ME340IA RECEIVER
#1 #2 #3 #4 #5 #6 #7 #8 #9 #10 #11 #12 #13 #14 (OPT11)

Fig. 3-3 Receiver Front Panel

Table 3-3 Explanation of Controls (Receiver Front Panel)

No.	Label	Function	Refer to (Paragraph)
#1	POWER	Turns the power ON or OFF	
#2	INPUT	Selects the type of input signal from UNIPOLAR, DS-1, DS-1C, DS-2, DS-3, and DSX-3 For the UNIPOLAR signal, set the mode using FUNCTION SWITCH (A1, A2) #40 on the rear panel.	5.2 (1)

Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#2 (cont'd)			

INPUT	PRBS	FRAME	BIPOLAR CODE
DSX-3 H/L	$2^{15}-1$ or $2^{23}-1$	DS-3 FRAME	B3ZS
DS-3 H/L	Selected using FUNCTION SWITCH (C2) #30 on rear panel		
DS-2	$2^{20}-1$	DS-2 FRAME	B6ZS
DS-1C	$2^{20}-1$ (with 14-zero constraint)	DS-1C FRAME	AMI
DS-1	$2^{20}-1$ (with 14-zero constraint)	D4 or ESF Selected using the [FRAME] key #4	AMI or B8ZS Selected using the [DS-1 CODE] key #3
UNIPOLAR	Selected using FUNCTION SWITCH (A1, A2) #30 on rear panel		

#3	DS-1 CODE	Sets the DS-1 code The following codes are set automatically for other than DS-1. DS-3: B3ZS DS-2: B6ZS DS-1C: AMI	5.1 (2)
#4	FRAME	Turns the frame ON or OFF For the DS-1 input signal, select D4 or ESF. When ESF is selected, 6 or 7 seconds may be required until frame synchronization is restored.	5.1 (3)

Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#5	UNIPOLAR INPUT CLOCK DATA	Unipolar signal input connectors Set the input level using UNIPOLAR INPUT LEVEL switch #39 on the rear panel.	5.2 (1) b
#6	DEMUX	This key is only effective in the DS-3 input signal mode (including DSX-3 and UNIPOLAR DS-3 modes), and when [FRAME] key #4 is on. When this key is ON (key LED ON), BIT error and CRC-6 error measurements are performed for the pre-set DS-1 channel signal in the DS-3 signal. The pre-set channel is displayed on the DS-1 CHANNEL display #19. To automatically increment or decrement the pre-set channel value, press the DEMUX [⩓] or [⩔] key for about one second.	
#7	PATTERN	Selects a pattern To measure BIT error, a pattern must be set. When BIT error measurement is not required, set the pattern to LIVE. The PRBS contents are as follows: DS-3: 2^{15}-1 or 2^{23}-1 (according to FUNCTION SWITCH (C2) #40 setting) DS-2: 2^{20}-1 DS-1C/DS-1: 2^{20}-1 (with 14 zero constraint)	5.1 (4)
#8	DS-1/DS-1C/ DS-2 INPUT	DS-1/DS-1C/DS-2 signal input connector	

Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#9	MEASUREMENT	Selects the error type to be measured and the item to be displayed	
		Error type CRC-6, BIP-V, FRAME, PARITY, BIT	5.2 (2) (3) (4)
		Item TH ES, % EFS, ES, ER COUNT, ER RATE	
		Set the TH ES threshold value FUNCTION SWITCH (A3 to A6) #40.	
		BIT: Measured when [PATTERN] key #7 is not set to LIVE. If [DEMUX] key #6 is on, bit error measurement is performed for the DS-1 signal.	
		PARITY: Only measured for the DS-3 input signal and when [FRAME] key #4 is on	
		FRAME: Only measured when [FRAME] key #4 is on	
		BIP V: Only measured when [INPUT] key #2 is not set to UNIPOLAR and [DEMUX] key #6 is off	
		CRC-6: Only measured when [FRAME] key #4 is set to ESF	
#10	DS-3 INPUT	DS-3 signal input connector	5.2 (1)
#11	TIME	Sets the measuring time and real time	3.3.2 (2)
		TIMED: Displays the remaining measuring time	
		ELAPSED: Displays the elapsed measuring time	
		INTERVAL: Displays the set measuring time The INTERVAL can be set by specifying time or clock count according to FUNCTION SWITCH (C4) #40 setting.	

Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#11 (cont'd)		REAL TIME: Displays the date and time REPEAT: Repeats measurement at the set measuring time SINGLE: Performs measurement only once at the set measuring time UNTIMED: Measurement is started or stopped using the [START/STOP] key [START/STOP] key: Starts or stops measurement This key is effective in the REPEAT and SINGLE modes. [PAUSE/CONT] key: Pauses or continues measurement . Measuring time setting method 1. Set the TIME [DISPLAY] key to INTERVAL. 2. Use key #24 to change the display of the YMD(YEAR/MONTH/DAY) or HMS (HOUR/MINUTE/SECOND) or vice versa. 3. Press the [TIME SET] key. The two digits on the TIME/JITTER display #23 will start blinking. 4. Select the digit to be set using the [MODE ≪] key. 5. Set the measuring time using the [PULSE/CONT ∧] or [START/STOP ∨] key. Press the [PAUSE/CONT ∧] or [START STOP ∨] key for about one second to automatically increment or decrement the value. 6. Turn off the [TIME SET] key.	

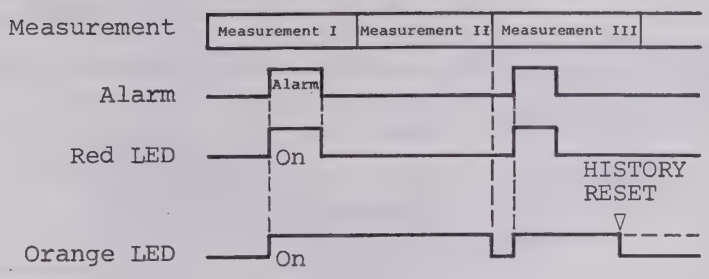
Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#11 (cont'd)		. Time and date setting method 1. Set the TIME [DISPLAY] key to REAL TIME. 2. Set the correct data and time in the same way as the measuring time.	
#12	BUZZER	When this key is on, the buzzer will be activated by the following: . SIGNAL LOSS . FRAME LOSS . PATTERN SY LOSS . BLUE SIGNAL . ERRORS (only for errors specified by MEASUREMENT [ERROR] key #9)	
#13	MANUAL PRINT	When pressed, outputs all data accumulated from the start of measurement to the built-in printer. Data is output only when the built-in printer (OPT11) is mounted and the [PRINT] key #14 is on.	
#14	(Built-in printer) (OPT11)	Outputs the following data when the [PRINT] key is on (the right side LED is ON): . Measured results . Error occurrence . Alarm occurrence and recovery The above data to be printed can be selected using FUNCTION SWITCH (B1 to B8, C8) #40. To replenish the printer paper, loosen the top-left screw on the printer and pull the printer forward. See the instructions at the inside top for details on how to replenish the printer paper.	3.2.5

Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#15	CONTROL	To initialize the instrument, turn on the POWER switch #1 while pressing this key. Note that the time is not initialized.	
#16	PANEL LOCK	Turn on this key to make all keys ineffective (except the POWER switch #1)	
#17	AUTO SET	Turning this key on sets the instrument into pre-programmed status and makes all keys ineffective (except this one, POWER switch #1, [INPUT] key #2, [START/STOP] key, and [PAUSE/CONT] key) Measurement starts at [AUTO SET] key ON. . AUTO SET status change method 1. Turn on the [AUTO SET] key while pressing [CONTROL] key #15. How the panel keys are ready to be set. 2. Set the panel keys to the required status. 3. Turn off the [AUTO SET] key. The changed contents are set each time the [AUTO SET] key is turned on.	
#18	STATUS	Indicates the alarm status The red LED remains on until the alarm status is released. When the orange LED lights, it indicates that an alarm was previously generated. This LED goes off when: the next measurement is completed, or the [HISTORY RESET] key is pressed.	

Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#18 (cont'd)			

Alarm status:

1. AC POWER FAIL: Lights when the instrument recovers from power failure
2. SIGNAL LOSS: Lights when there is no input signal
3. FRAME LOSS: Lights when frame synchronization is lost
4. PATT SY LOSS: Lights when pattern synchronization is lost
5. BLUE SIGNAL:

   Lights under the following conditions.

   DS-3: 1010 pattern is continuously received for approx. 250 bits or more

   DS-2, DS-1C, and DS-1: An all-ones pattern is continuously received for approx. 250 bits or more

Table 3-3 Explanation of Controls (Receiver Front Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#19	DS-1 CHANNEL	Displays the channel of the DS-1 signal to be extracted from the DS-3 signal when the [DEMUX] key #6 is on	
#20	ERRORS	Lights if the error selected, using the MEASUREMENT [ERROR] key #9, occurs Note that this LED does not light if the measurement is stopped or suspended (GATING LED #22 is off).	
#21	MEASUREMENT	Displays the measured result of the item selected using the MEASUREMENT [DISPLAY] key #9. When the TIME [MODE] key #11 is set to the REPEAT or SINGLE mode, the display changes each time a measurement is completed. In the UNTIMED mode, the display changes every second.	
#22	GATING	Remains on during the measurement	
#23	TIME/JITTER	Displays the set measuring time, real time, or jitter amplitude Use key #24 to select the display contents. When JITTER is selected and the jitter measuring circuit is not synchronized, the display will start blinking.	
#24		Selects the display contents for TIME/ JITTER #23 HMS, YMD: Time and date (measuring time/real time) UIp-p: Jitter amplitude	
#25	JITTER (OPT02)	If this option is not mounted, MEAS is always off A filter must be selected when MEAS is on.	3.3.3 (9)

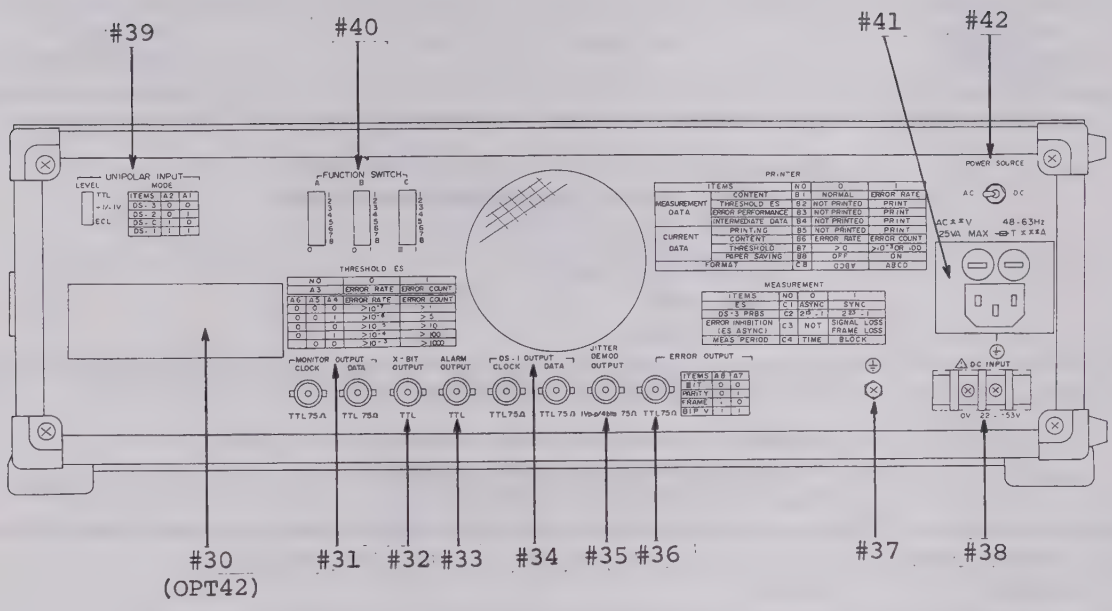


Fig. 3-4 Receiver Rear Panel

Table 3-4 Explanation of Controls (Receiver Rear Panel)

No.	Label	Function	Refer to (Paragraph)
#26 to #29		Not assigned	
#30	(OPT42 or OPT44)	GP-IB interface or RS-232C interface The RS-232C interface can be mounted here instead of the GP-IB.	Section 7 Section 8
#31	MONITOR OUTPUT	Outputs input signal for monitoring The output waveform is unipolar.	
#32	X-BIT OUTPUT	X-bit output connector Outputs X-bit in DS-3, DS-2, and DS-1C frames.	

Table 3-4 Explanation of Controls (Receiver Rear Panel) (continued)

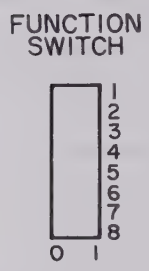
No.	Label	Function	Refer to (Paragraph)
#33	ALARM OUTPUT	Alarm signal output connector The output level changes to TTL High if one of the following alarms occur: . SIGNAL LOSS . PATTERN SY LOSS . FRAME LOSS . BLUE SIGNAL	
#34	DS-1 OUTPUT	DS-1 signal output connector Outputs a unipolar DS-1 signal extracted from the DS-3 signal when the [DEMUX] key #6 is on.	
#35	JITTER DEMOD OUTPUT	Outputs a regenerated jitter modulation signal	
#36	ERROR OUTPUT	Error output connector Outputs the error selected using FUNCTION SWITCH (A7, A8) #40. When the [FRAME] key #4 is set to ESF, a CRC-6 error is output instead of a PARITY error.	
#37	⏚	Ground terminal	
#38	DC INPUT	Dc power source input terminal	
#39	UNIPOLAR INPUT LEVEL	Sets the unipolar signal output level	
#40	FUNCTION SWITCH	Sets additional functions The functions and settings are printed on the rear panel.	3.2.4
#41	AC**V	Ac inlet with fuse holder	

Table 3-4 Explanation of Controls (Receiver Rear Panel) (continued)

No.	Label	Function	Refer to (Paragraph)
#42	POWER SOURCE	Switches the power source from ac to dc or vice versa When using the switch, be sure to turn off the POWER switch #1 first.	

3.2.3 Transmitter FUNCTION SWITCH #30 (Rear panel)

This 8-bit switch sets additional functions. Each switch is set to "0" in the initial state. Switches A7 and A8 can not be used and must always be set to "0".



EXTERNAL CLOCK

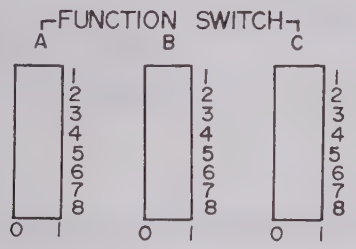
ITEMS	A2	A1
DS-3	0	0
DS-2	0	1
DS-1C	1	0
DS-1	1	1

DATA OUTPUT

ITEMS	NO	0	1
DS-3 PRBS	A3	$2^{15}-1$	$2^{23}-1$
DS-3 CODE (PATT 1000)	A4	B3ZS	AMI
DS-2 LEVEL	A5	DSX-2	HIGH
EXT ERROR	A6	SINGLE	BURST

3.2.4 Receiver FUNCTION SWITCH A, B, and C #40 (Rear panel)

These three 8-bit switches set additional functions. All function switches are set to "0" in the initial state. Switches C5 to C7 cannot be used and must always be set to "0".



SWITCH A

MODE

ITEMS	A2	A1
DS-3	0	0
DS-2	0	1
DS-1C	1	0
DS-1	1	1

SWITCH B, C

PRINTER

ITEMS		NO	0	1
MEASUREMENT DATA	CONTENT	B1	NORMAL	ERROR RATE
	THRESHOLD ES	B2	NOT PRINTED	PRINT
	ERROR PERFORMANCE	B3	NOT PRINTED	PRINT
	INTERMEDIATE DATA	B4	NOT PRINTED	PRINT
CURRENT DATA	PRINTING	B5	NOT PRINTED	PRINT
	CONTENT	B6	ERROR RATE	ERROR COUNT
	THRESHOLD	B7	>0	$>10^{-3}$ OR 100
	PAPER SAVING	B8	OFF	ON
FORMAT		C8	ABCD	ABCD

THRESHOLD ES

NO			0	1
A3			ERROR RATE	ERROR COUNT
A6	A5	A4	ERROR RATE	ERROR COUNT
0	0	0	$>10^{-7}$	>1
0	0	1	$>10^{-6}$	>5
0	1	0	$>10^{-5}$	>10
0	1	1	$>10^{-4}$	>100
1	0	0	$>10^{-3}$	>1000

ERROR OUTPUT

ITEMS	A8	A7
BIT	0	0
PARITY	0	1
FRAME	1	0
BIP V	1	1

SWITCH C

MEASUREMENT

ITEMS	NO	0	1
ES	C1	ASYNC	SYNC
DS-3 PRBS	C2	$2^{15}-1$	$2^{23}-1$
ERROR INHIBITION (ES ASYNC)	C3	NOT	SIGNAL LOSS FRAME LOSS
MEAS PERIOD	C4	TIME	BLOCK

(1) A1 and A2

Switches A1 and A2 set the input mode when the DATA INPUT [INPUT] key #2 is set to UNIPOLAR because the frame, code, and PRBS pattern depend on the input mode.

A1 = 0, A2 = 0: DS-3
A1 = 1, A2 = 0: DS-2
A1 = 0, A2 = 1: DS-1C
A1 = 1, A2 = 2: DS-1

(2) A3 to A6

Switches A3 to A6 set the threshold value when the MEASUREMENT [DISPLAY] key #9 is set to TH ES.

A3 is set to "0".

The threshold value is set by the error rate as follows:

Switches A4, A5 and A6 settings	Threshold value
A4 = 0, A5 = 0, A6 = 0	$>10^{-7}$
A4 = 1, A5 = 0, A6 = 0	$>10^{-6}$
A4 = 0, A5 = 1, A6 = 0	$>10^{-5}$
A4 = 1, A5 = 1, A6 = 0	$>10^{-4}$
A4 = 0, A5 = 0, A6 = 1	$>10^{-3}$

A3 is set to "1".

The threshold value is set by the error count as follows:

Switches A4, A5, and A6 settings	Threshold value
A4 = 0, A5 = 0, A6 = 0	>1
A4 = 1, A5 = 0, A6 = 0	>5
A4 = 0, A5 = 1, A6 = 0	>10
A4 = 1, A5 = 1, A6 = 0	>100
A4 = 0, A5 = 0, A6 = 1	>1000

(3) A7 and A8

Switches A7 and A8 select the error output type.

A7 = 0, A8 = 0: Bit error

A7 = 1, A8 = 0: Parity error (DS-3)
When the DATA INPUT [FRAME] key #4 is set to ESF (DS-1), the error output type is CRC-6.

A7 = 0, A8 = 1: Frame error

A7 = 1, A8 = 1: Bipolar violation error

(4) B1 to B8, and C8

Switches B1 to B8 and C8 change the printer output format.

See paragraph 3.2.5, for details.

(5) C1

Switch C1 changes the error second (ES) mode.

C1 = 0: Asynchronous
C1 = 1: Synchronous

Note:

In the synchronous mode (C1=1), the error performance data is not printed.

(6) C2

Switch C2 changes the PRBS pattern when the input signal is DSX-3, DS-3 or UNIPOLAR DS-3.

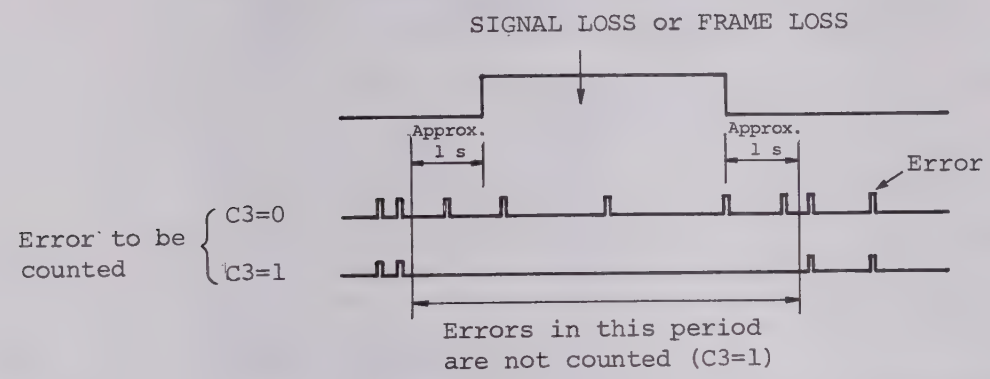
C2 = 0: PRBS $2^{15}-1$
C2 = 1: PRBS $2^{23}-1$

(7) C3

Switch C3 selects error inhibition or no error-inhibition at SIGNAL LOSS or FRAME LOSS.

C3 = 0: No error-inhibition

C3 = 1: Error inhibition



Note:

When the error second (ES) mode is set to synchronous mode (C1=1), error inhibition is not performed.

Do not change switch setting during measurement.

(8) C4

Switch C4 changes the measuring time setting method.

C4 = 0: Measuring time is set by time

Example:

1 second, 15 minutes 30 seconds, 10 days

C4 = 1: Measuring time is set by clock count

Example:

10^8 bits, 10^9 bits

When the measuring time is set by clock count, only error rate and error count can be measured.

3.2.5 Built-in Printer (OPT11)

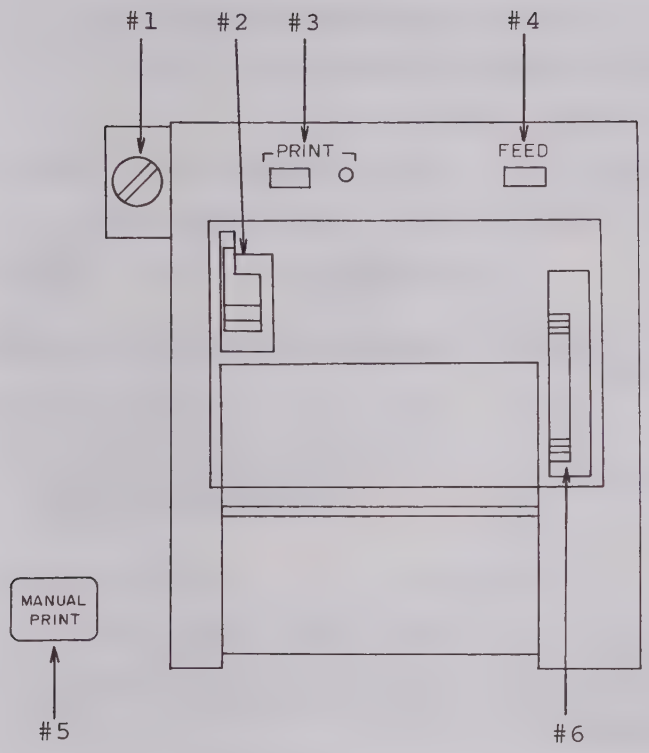


Fig. 3-5 Built-in Printer

Table 3-5 Explanation of Controls
(Built-in Printer)

No.	Label	Function
#1		To replenish the printer paper, loosen this screw and pull the printer forward. See the instructions on the inside top for details on how to replenish the printer paper.
#2		Lift this lever when replenishing the printer paper. Press the lever down after replenishing the paper.
#3	PRINT	Turn this key on (right side LED on) when printing.
#4	FEED	Paper feed key
#5	MANUAL PRINT	When this key is pressed, all data accumulated from the start of measurement is output to the printer.
#6		Paper feed knob

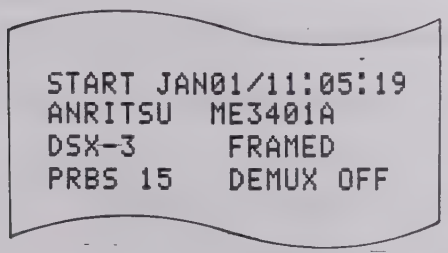
(1) Printing data type

(a) Measurement start data

Measurement start data is output at the start of measurement.

In the REPEAT mode, this data is only output when measurement first starts.

Print out example



(b) Measurement end data

Measurement end data is output at the end of a measurement.

Data contents

. Measurement start time
. Measurement end time
. Elapsed measuring time
. Measured result of each error
. Total time of each alarm
. Jitter amplitude
. Threshold ES
. Error performance data

Set the function switches B1, B2, and B3 on the receiver rear panel to print or not print the threshold ES and error performance data.

PRINTER

ITEMS		NO	0	1
MEASUREMENT DATA	CONTENT	B 1	NORMAL	ERROR RATE
	THRESHOLD ES	B2	NOT PRINTED	PRINT
	ERROR PERFORMANCE	B3	NOT PRINTED	PRINT

B1: Changes the data contents.

B1 = 0: Ordinary data

B1 = 1: Error rate and jitter amplitude
(No jitter amplitude is output if the jitter measurement function is set off.)

B2: Turns threshold data printing on or off.

The threshold data is only printed when B1 = 0.

B2 = 0: Does not print
B2 = 1: Prints

B3: Turns error performance data printing on or off.

The error performance data is only printed when B1 = 0 and the ES mode is set to ASYNC (C1 = 0).

B3 = 0: Does not print
B3 = 1: Prints

Print out example

The printer prints approximately two or three lines per second.

Therefore, select the data to be printed as follows for a short measuring time:

Less than 10 s: Print only the error rate and jitter amplitude data.

Less than 1 min: Turn off the threshold ES and error performance data output.
(B2 = 0, B3 = 0)

1. Ordinary data
   (B1 = 0, B2 = 0, B3 = 0)

```
********************
START JAN01/11:05:19
END   JAN01/11:05:49
ELAPSED  00/00:00:30
* MEAS DATA (DS-3) *
        BIT     BIP V
 ER 7.5E-09 0.0E-10
 EC      10        0
 ES      10        0
%EFS 66.6667     100
      PARITY   FRAME
 ER 7.5E-09 0.0E-07
 EC      10        0
 ES      10        0
%EFS 66.6667     100
*  ALARM SECONDS   *
 POW F  0s SIG L  0s
 FRM L  0s BLUE   0s
 PAT L  0s XBIT   0s
* JITTER  1.06UI-PP*
********************
```

2. Error rate and jitter amplitude data
   only (B1 = 1, B2 = 0, B3 = 0)

```
* END JAN01/11:13:43
 B=1.0E-02 V=0.0E-10
 P=1.1E-04 F=1.0E-02
* JITTER  1.06UI-PP*
```

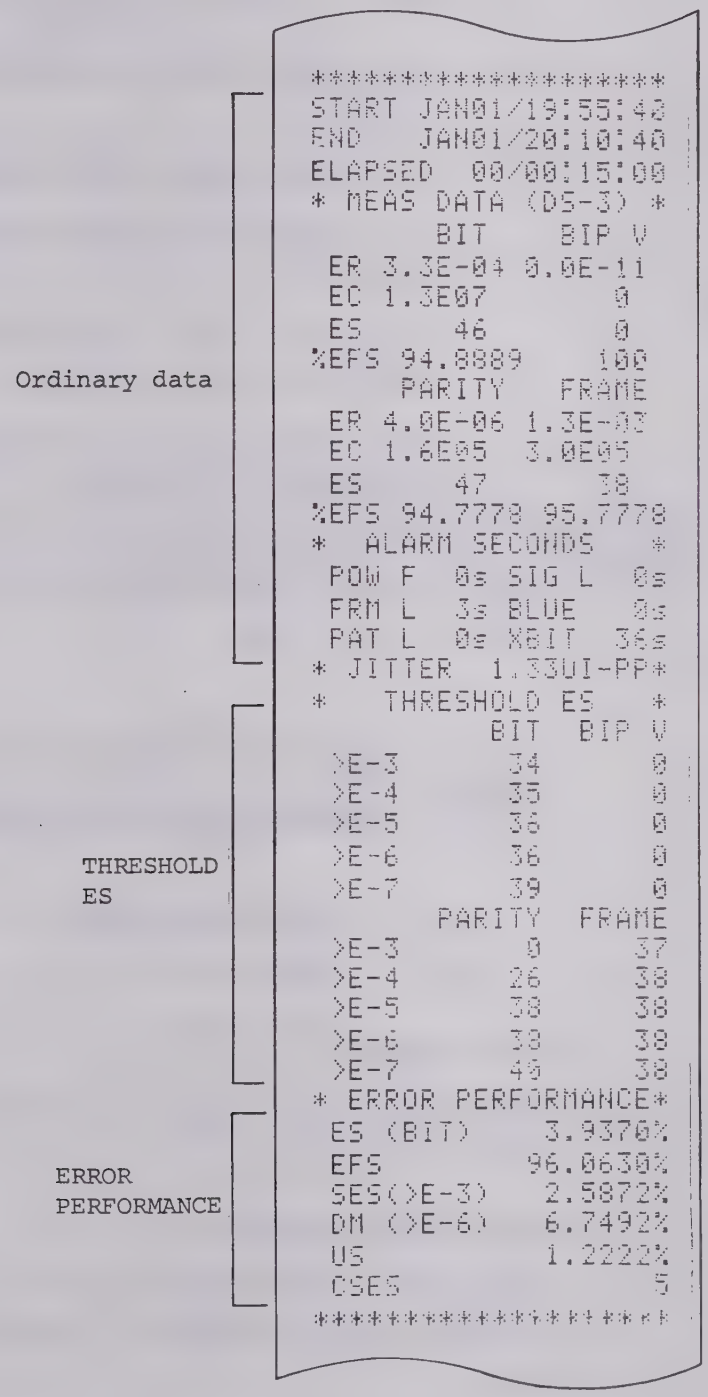
B: Bit error

V: Bipolar Violation error

P: Parity error

F: Frame error

3. All data (Ordinary data, threshold ES data, and error performance data) (B1 = 0, B2 = 1, B3 = 1)



(c) Intermediate data

Any data accumulated between start data and end data is intermediate data. This data is classified into the following two types:

(i) Data output when the [MANUAL PRINT] key #13 is pressed

(ii) Data output during the following cycles:

- No output for a measurement time two hours or less
- Every two hours for a measurement time exceeding two hours but less than two days
- Every two days for a measurement time exceeding two days.

Set the function switch B4 on the receiver rear panel to print or not print the data of paragraph 3.2.5 (1) (c) (ii).

PRINTER

ITEMS		NO	0	1
MEASUREMENT DATA	INTERMEDIATE DATA	B4	NOT PRINTED	PRINT

B4 = 0: Does not print
B4 = 1: Prints

Data contents

Same as the measurement end data. See paragraph 3.2.5 (1) (b).

Print out example

Intermediate data is printed in the same format as measurement end data. However, INT replaces END.

(d) Current data

Current data is only output in case an error is detected.

Data contents

. Error occurrence time

. Error amount (Average error rate per second or error count per second)

See the function switches B5 to B8 on the receiver rear panel to print or not print the above data.

PRINTER

ITEMS		NO	0	1
CURRENT DATA	PRINTING	B5	NOT PRINTED	PRINT
	CONTENT	B6	ERROR RATE	ERROR COUNT
	THRESHOLD	B7	>0	$>10^{-3}$ OR 100
	PAPER SAVING	B8	OFF	ON

B5: Printing ON/OFF

B5 = 0: Does not print
B5 = 1: Prints

B6: Data selection

B6 = 0: Error rate
B6 = 1: Error count
B7: Printing conditions

B7 = 0: Prints data when one or more error is detected.

B7 = 1: Prints data when the error rate exceeds 10^{-3} (B6 = 0) or the error count exceeds 100 (B6 = 1).

B8: Printer paper save function

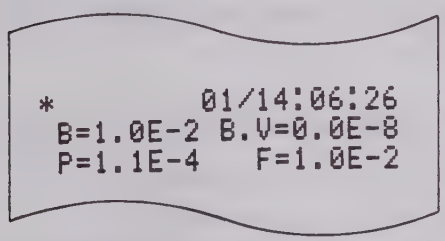
If printing continues, this function interrupts printing in accordance with the following procedures:

Step	Procedure
1	Stops printing if printing continues for 10 seconds.
2	Releases the print stop status if no errors occur (B7 = 0) or an error below the threshold value (B7 = 1) continues for 10 seconds.
3	Repeats steps 1 and 2.

B8 = 0: Does not interrupt printing.
B8 = 1: Interrupts printing.

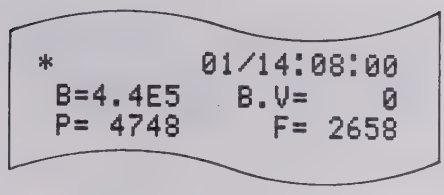
Print out example

1. Error rate
   (B5 = 1, B6 = 0)

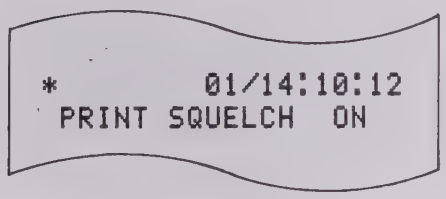


B: Bit error
V: Bipolar Violation error
P: Parity error
F: Frame error

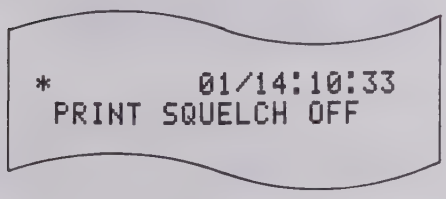
2. Error count
   (B5 = 1, B6 = 1)



3. Printing interrupted by paper save function



4. Printing interruption released by paper save function



(e) Alarm data

Alarm data is output if an alarm occurs or is recovered.

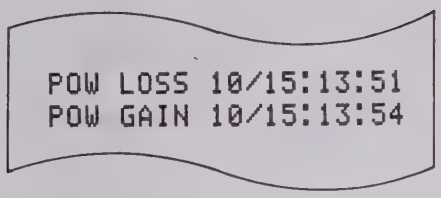
In case of ac power failure, the data is only output when it is recovered.

Data contents

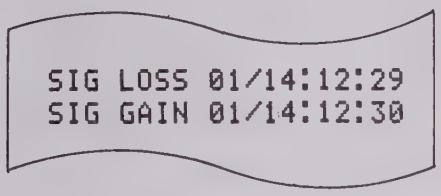
. Alarm occurrence time or recovery time
. Alarm type

Print out example

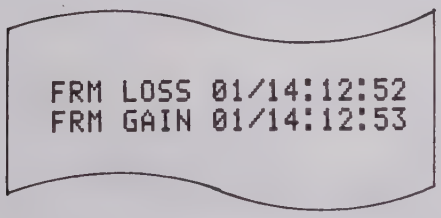
1. AC power fail

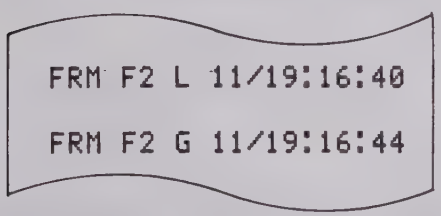


2. Signal Loss



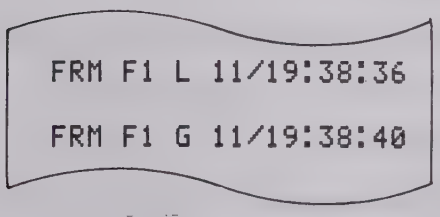
3. Frame Loss





DS-2 frame loss when the [DEMUX] key is ON.

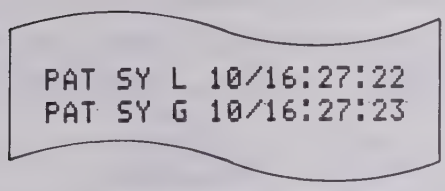
L: LOSS G: GAIN



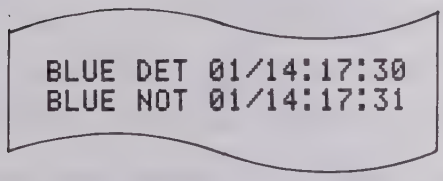
DS-1 frame loss when the [DEMUX] key is ON.

L: LOSS G: GAIN

4. Pattern sync Loss



5. Blue signal

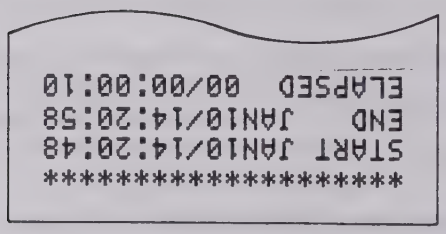


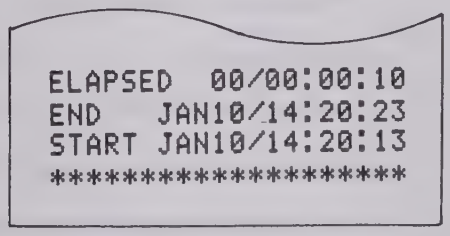
(2) Priting direction

The printing direction can be changed from forward to reverse or vice versa by using function switch C8 on the receiver rear panel as follows:

PRINTER

ITEMS	NO	0	1
FORMAT	C8	ABCD	ABCD



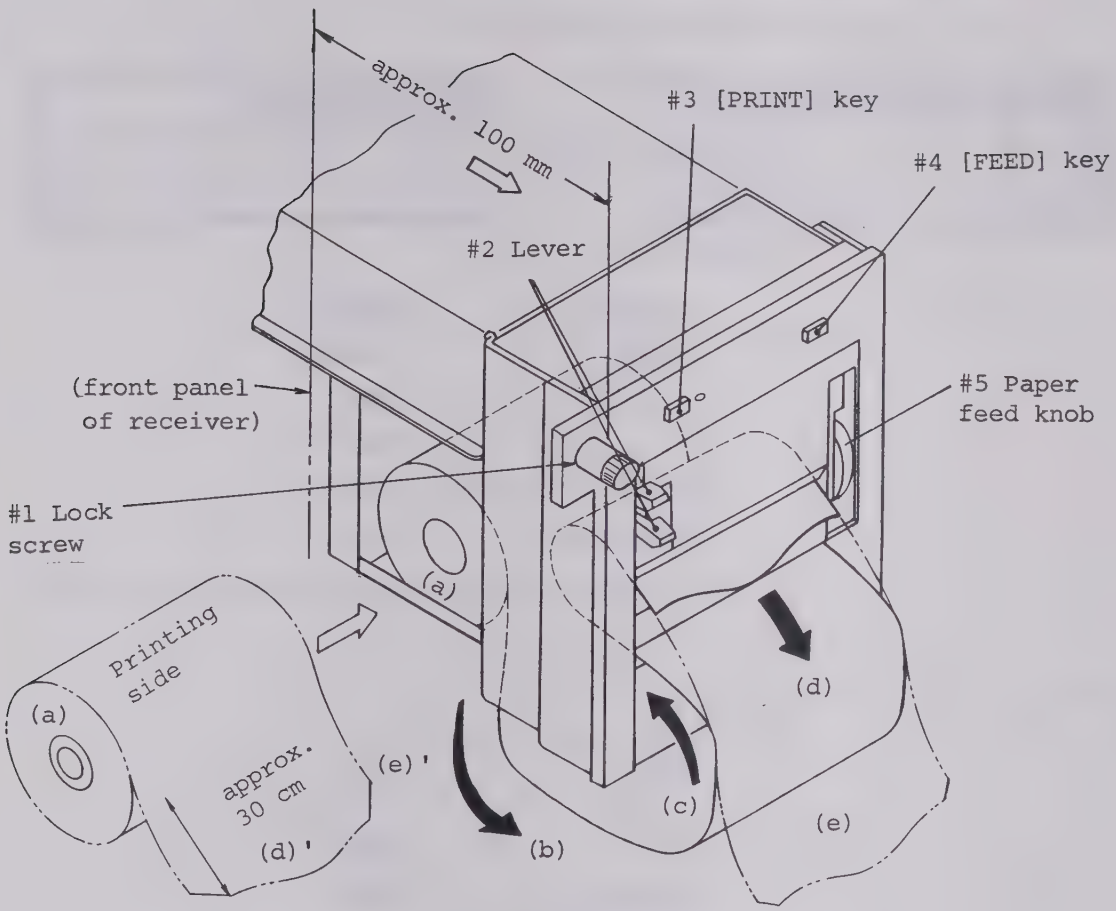


C8 = 0 (Forward) C8 = 1 (Reverse)

(3) Printing paper replacement

A red mark on the edge of the thermal recording paper indicates that the paper is about to run out (1 m remaining). Replace the paper as follows:

Step	Procedure
1	Set the [PRINT] key #3 to OFF.
2	Turn the printer lock screw #1 counterclockwise to unlock the printer.
	Hold the lock screw #1 and slowly pull the printer out until it stops (halfway, approximately 100 mm).
3	Remove the remaining paper and insert a new roll.
	The print side is on the outside of the roll.
	Before loading the paper, unroll approximately 300 mm as shown in Fig. 3-6.
4	Lift lever #2 and feed the recording paper through (c) and (d) shown in Fig. 3-6.
	If it is difficult to feed the paper through slot (c) and (d), trim the corners of the leading edge.
5	Pull the paper straight, press the lever #2 down, and then press the [FEED] key #4 to feed the paper.
	The paper can also be fed using the feed wheel #5.
6	Gently push the printer back until it is fully inserted into the receiver unit.
7	Fasten the lock screw #1.
8	To resume printing, turn the [PRINT] key #3 ON.



Note

When transporting or moving the instrument, the recording paper must be removed.

(e)': Cut the corners of the leading edge.

Fig. 3-6 Replacing Recording Paper

(4) Use example

(a) Measured data recording

(i) Panel setting

Set the transmitter and receiver as shown below.

Transmitter

CLOCK	: DS-3
FRAME	: FRAMED
PATTERN	: PRBS
DS-3 LEVEL	: DSX-3
ERROR ADDITION	: OFF
MODULATION	: OFF

Set function switches A3 on the rear panel to "0".

Receiver

INPUT	: DSX-3
FRAME	: FRAMED
DEMUX	: OFF
PATTERN	: PRBS
DISPLAY	: ER RATE
ERROR	: BIT
START/STOP	: STOP
PAUSE/CONT	: OFF (CONT)
TIME DISPLAY	: TIMED
MODE	: SINGLE (Set MEAS TIME to 10 seconds.)
JITTER	: OFF
PRINT	: ON

Set function switches B1 to B8, C1 to C4 and C8 on the rear panel to "0".

(ii) Setup

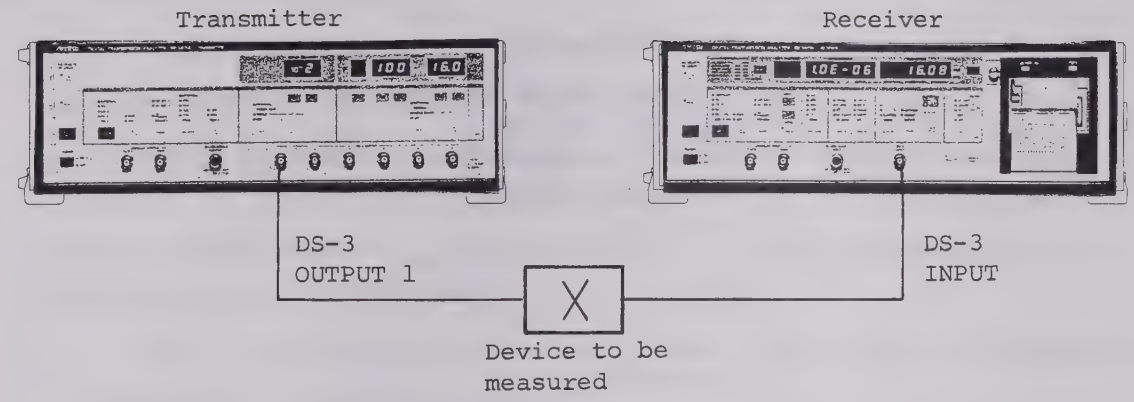
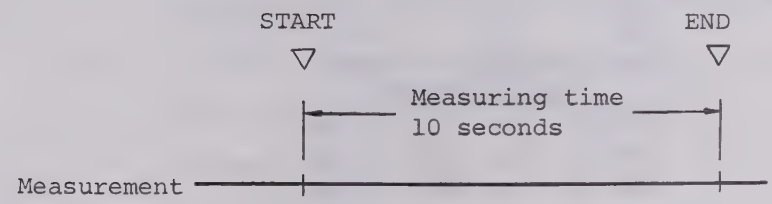
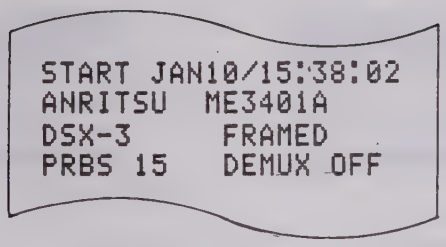


Fig. 3-7 Setup

(iii) Print out example

When the measurement is started, the following output is printed at the start and 10 seconds after starting.





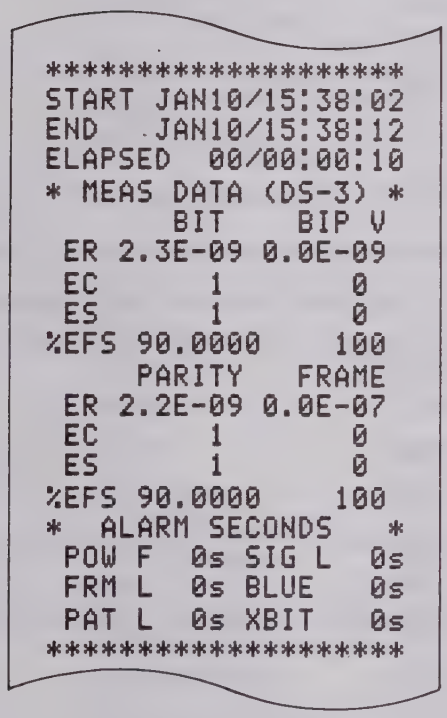


Fig. 3-8 Print out Example

3.3 Measurement

3.3.1 Back-to-back check

Before starting measurement, check the back-to-back performance of the ME3401A.

This paragraph is concerned with verifying that the ME3401A is operating normally when it is first unpacked, after being moved a long distance, or after being out of service for a long time.

The following back-to-back check uses only the ME3401A transmitter and receiver.

(1) Panel setting

(a) Set the transmitter and receiver to the initial state.

When the [POWER] switch is turned on, while holding [CONTROL] key pressed until the LED test is finished (all front panel LEDs and lit for approx. 2 seconds), the transmitter/receiver are initialized except for the receiver clock.

(b) At initialization, the transmitter and receiver settings are as shown below.

Transmitter

CLOCK	: DS-3
FRAME	: FRAMED
PATTERN	: PRBS
DS-3 LEVEL	: DSX-3
ERROR ADDITION	: OFF
JITTER MODULATION	: OFF

Receiver

INPUT	: DSX-3 H/L
FRAME	: FRAMED
DEMUX	: OFF
PATTERN	: PRBS

DISPLAY	:	ER RATE
ERROR	:	BIT
TIME DISPLAY	:	TIMED
MODE	:	REPEAT (MEAS TIME is one second)
START/STOP	:	START
PAUSE/CONT	:	CONT
JITTER	:	OFF
BUZZER	:	OFF
PRINT	:	OFF

(c) Set the FUNCTION SWITCH on the rear panel to "0" for both the transmitter (A1 to A6) and receiver (A1 to A6, B1 to B8, C1 to C4 and C1 to C8).

(2) Setup

Set-up as shown in Fig. 3-9.

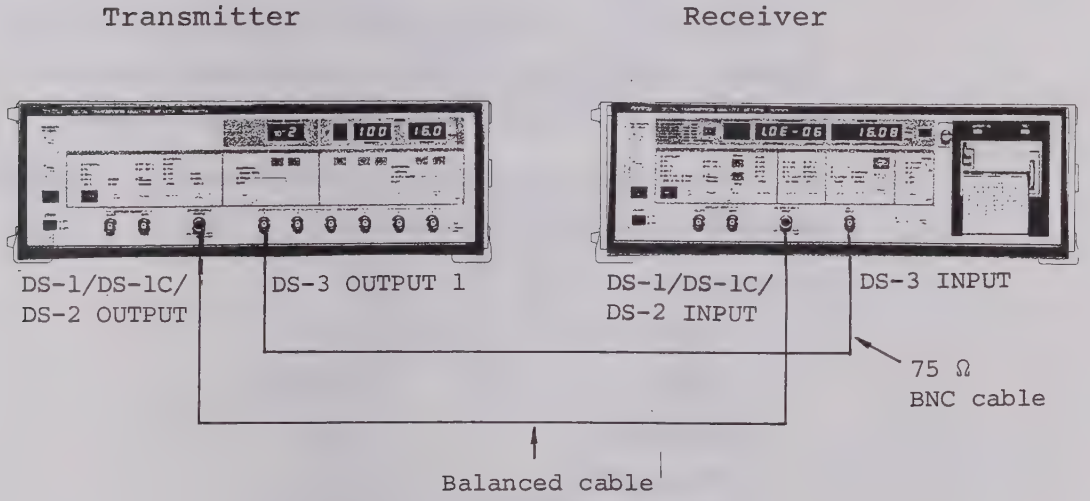


Fig. 3-9 Setup

(3) Check procedure

Check steps (a) to (e) in sequence. If all checks are normal, measurement can be performed.

(a) Error-free confirmation

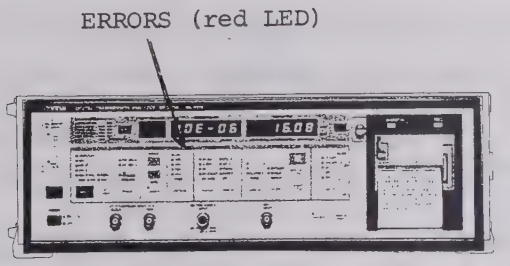


Fig. 3-10 Receiver

Step	Procedure
1	Check that the receiver ERRORS LED (red) is off.
2	Set [FRAME] of the transmitter and receiver to UNFRAMED and check that the receiver ERRORS is off.
3	Reset [FRAME] of the transmitter and receiver to FRAMED.
4	Set [PATTERN] of the transmitter and receiver to PRBS→1111→1100→1010→1000 in this sequence and check that the receiver ERRORS LED is off.
5	Reset [PATTERN] to PRBS.

(continued)

Step	Procedure
6	Set [DS-3 LEVEL] of the transmitter to HIGH and [INPUT] of the receiver to DS-3H/L, and check that the receiver ERRORS LED is off.
7	Set [DS-3 LEVEL] of the transmitter to LOW and check that the receiver ERRORS LED is off.
8	Reset [DS-3 LEVEL] of the transmitter to DSX-3 and [INPUT] of the receiver to DSX-3 H/L.
9	Set [ERROR] of the receiver to BIT→PARITY→FRAME→ BIP V in this sequence and check that the receiver ERRORS LED is off at each ERROR setting.
10	Set [CLOCK] of the transmitter to DS-2 and set [INPUT] of the receiver to DS-2, and check that the ERRORS LED of the receiver is off.
11	Set [CLOCK] of the transmitter to DS-1C and set [INPUT] of the receiver to DS-1C, and check that the ERRORS LED of the receiver is off.
12	Set both [CLOCK] of the transmitter and [INPUT] of the receiver to DS-1, and check that the ERRORS LED of the receiver is off.
13	Set [DS-1 CODE] of both the transmitter and receiver to B8ZS, and check that the ERRORS LED of the receiver is off.
14	Set [FRAME] of the transmitter and receiver to ESF, and check that the ERRORS LED of the receiver is off. It may take about 10 seconds for the FRAME LOSS and ERRORS LEDs of the receiver to go off.

(continued)

Step	Procedure
15	Reset [DS-1 CODE] of the transmitter to AMI and [FRAME] to D4.
16	Reset [DS-1 CODE] of the receiver to AMI and [FRAME] to D4.
17	Reset [CLOCK] of the transmitter to DS-3 and [INPUT] of the receiver to DSX-3 H/L.

(b) Error addition

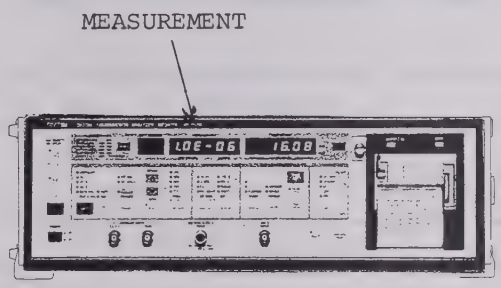


Fig. 3-11 Receiver

Step	Procedure
1	Initialize transmitter and receiver. (See paragraph 3.3.1 (1)(b).)
2	Set [ADD] of the transmitter to SINGLE.
3	Press key at right of [ADD].
4	Check that the measured result of the receiver is within the range shown in the following table.
5	Set [ADD] of the transmitter to ERROR RATE.

(continued)

Step	Procedure
6	Set ERROR RATE to 10^{-2} and check that the measured result of the receiver is within the range shown in the following table.
7	Repeat step 6 for ERROR RATE 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}, and 10^{-9}. Note: For ERROR RATE 10^{-7}, 10^{-8}, 10^{-9}, change the measuring time according to the following table.

Transmitter	Receiver		
ERROR ADDITION	ER RATE	Measuring time	Remarks
SINGLE	2.0×10^{-8} to 2.3×10^{-8}		
10^{-2}	9.5×10^{-3} to 1.05×10^{-2}		
10^{-3}	9.5×10^{-4} to 1.05×10^{-3}	1 second	
10^{-4}	9.5×10^{-5} to 1.05×10^{-4}		
10^{-5}	9.5×10^{-6} to 1.05×10^{-5}		
10^{-6}	9.5×10^{-7} to 1.05×10^{-6}		
10^{-7}	9.5×10^{-8} to 1.05×10^{-7}	5 seconds	Change the measuring time. For the change method, refer to Table 3-3, #11 in paragraph 3.2.2.
10^{-8}	9.5×10^{-9} to 1.05×10^{-8}	5 minutes	
10^{-9}	9.5×10^{-10} to 1.05×10^{-9}	30 minutes	

(c) Alarm detection check

Step	Procedure
1	Check that the transmitter and receiver are initialized as described in paragraph 3.3.1 (1) (b).

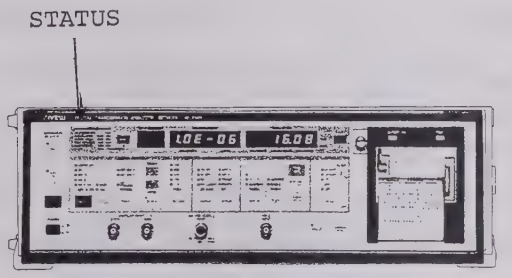


Fig. 3-12 Receiver

	. SIGNAL LOSS
2	Disconnect the BNC cable connected to DS-3 INPUT of the receiver in the setup shown in Fig. 3-9, and check that the receiver SIGNAL LOSS LEDs (red and orange) are on.
3	Check that only the orange LED remains lit when the cable is reconnected. The orange LED goes off when the next measurement is completed, or when the receiver [HISTORY RESET] is pressed.
4	Set [FRAME] of the transmitter to UNFRAMED and check that the FRAME LOSS LEDs (red and orange) are on.

(continued)

Step	Procedure
5	Check that only the orange LED remains lit when [FRAME] of the transmitter is reset to FRAMED. The orange LED goes off when the next measurement is completed, or when the receiver [HISTORY RESET] is pressed.
	. PATT SY LOSS, BLUE SIGNAL
6	Set [PATTERN] of the transmitter to 1010 and check that the receiver PATT SY LOSS LEDs (red and orange) and BLUE SIGNAL LEDs (red and orange) are on.
7	Check that only the orange LEDs of PATT SY LOSS and BLUE SIGNAL remain lit when [PATTERN] of the transmitter is reset to [PRBS]. The orange LEDs go off when the next measurement is completed, or when the receiver [HISTORY RESET] is pressed.
8	Set [CLOCK] of the transmitter to DS-2 and set [INPUT] of the receiver to DS-2.
9	Set [FRAME] of the transmitter and receiver to UNFRAMED and set [PATTERN] to 1111, and check that the BLUE SIGNAL LEDs (red and orange) are on.
10	Reset [CLOCK] of the transmitter to DS-3, and reset [FRAME] to FRAMED, and [PATTERN] to PRBS. Reset [INPUT] of the receiver to DSX-3 H/L.

(d) Printer (option 11)

Step	Procedure
1	Set the receiver as follows: START/STOP: STOP TIME SET : 10 seconds PRINT : ON
2	Set the [START/STOP] key to START and check that the following output is printed after 10 seconds.

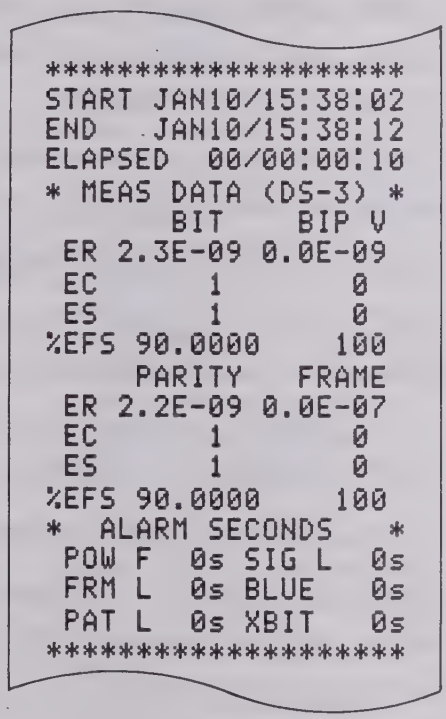


Fig. 3-13 Print out Example

3.3.2 Measurement preparation

Set the transmitter and receiver as follows according to the measurement objective.

(1) Transmitter

CLOCK: Set CLOCK according to the system to be measured.

When an external clock signal is used, set it to EXTERNAL and set the level (TTL, 0.7 to 1.5 Vp-p, ECL) with the EXTERNAL CLOCK INPUT LEVEL switch and MODE (DS-3, DS-2, DS-1C, and DS-1) with FUNCTION SWITCH A1 and A2 on the rear panel.

DS-1 CODE: Set it to the code of the system to be measured when CLOCK is DS-1.

FRAME: Usually set FRAME to FRAMED.

Set it to the frame (D4 or ESF) of the system to be measured when CLOCK is DS-1.

PATTERN: Set PATTERN according to the measurement item as shown in the table below.

Error rate measurement	PRBS Set FUNCTION SWITCH A3 on the rear panel to "1" when PRBS 2^{23}-1 is used in DS-3.
Output power measurement	1111 Set FRAME to UNFRAMED.
Blue signal detection check	At DS-3, set it to 1010. Set FRAME to FRAMED. At DS-1, DS-1C, and DS-2, it to 1111. Set FRAME to UNFRAMED.

(cont'd)

ISOLATE PULSE waveform check	1000 Set DS-3 CODE to AMI by setting FUNCTION SWITCH A4 on the rear panel to "1". Set FRAME to UNFRAMED.
When external data signal is used	EXTERNAL Set the level (TTL or ECL) with the EXTERNAL DATA INPUT LEVEL switch on rear panel.

DS-3 LEVEL:

Measurement at cross connect point	DSX-3
Measurement with rectangular waveform	HIGH
Measurement with waveform after passing 900 ft cable	LOW. Use No. 6 DS-3 OUTPUT connector.

ERROR ADDITION: Usually set to OFF

Not only a bit error but also a frame error, parity error (DS-3), and CRC-6 error (DS-1) can be added.

Therefore, using these errors, this function is used to check the error detection function of the equipment monitoring the line.

Also, after completing the measurement preparation, whether or not the transmitter and receiver are normal can be checked by confirming that the error rate added at the transmitter is the same as the error rate detected by the receiver. See paragraph 3.3.1 (3) (b).

JITTER: Usually set to OFF
(Option 01)

FUNCTION SWITCHes A1 to A6 (rear panel):

Usually set to "0"

(2) Receiver

INPUT: Set INPUT according to the bit rate and level* (DS-3 only) of the system to be measured. For UNIPOLAR, set MODE (DS-3, DS-2, DS-1C, and DS-1) and input level with the UNIPOLAR INPUT MODE and LEVEL switches on the rear panel.

*:

DSX-3 H/L: Measurement at cross connect point

DS-3 H/L: Measurement with rectangular waveform

DS-1 CODE: Set to the code of the system to be measured when INPUT is DS-1

FRAME: Usually set to FRAMED

Set it to the frame (D4 or ESF) of the system to be measured when INPUT is DS-1.

DEMUX: Turn ON when M13 MUX is measured.

PATTERN: Set PATTERN according to the system to be measured.

When the signal in service is measured, set PATTERN to LIVE. In this case, the bit error is not measured.

MEASUREMENT: Set the measurement item.
DISPLAY

ERROR: Set the kind of error to be measured.

INTERVAL: Set the measuring time. When FUNCTION SWITCH C4 on the rear panel is "0" or "1", the interval is set to TIME or BLOCK, respectively.

1. TIME

When the measuring time is set by time period, TIME is used.

The following equation shows the relationship between the measuring time and the measurable minimum error rate.

$$\text{Minimum error rate} = \frac{1}{\text{Measuring time (second)} \times \text{Frequency (Hz)}}$$

The following table is an example of the measuring time and error rate range.

Clock	Measuring time	Error rate
DS-1	1 second	9.9×10^{-2} to 6.4×10^{-7}
	65 seconds	9.9×10^{-2} to 1×10^{-8}
DS-1C	1 second	9.9×10^{-2} to 3.2×10^{-7}
	31 seconds	9.9×10^{-2} to 1×10^{-8}
DS-2	1 second	9.9×10^{-2} to 1.6×10^{-7}
	15 seconds	9.9×10^{-2} to 1×10^{-8}
DS-3	1 second	9.9×10^{-2} to 2.2×10^{-8}
	one day	9.9×10^{-2} to 2.6×10^{-13}
UNIPOLAR 50 MHz	1 second	9.9×10^{-2} to 2×10^{-8}
	20 seconds	9.9×10^{-2} to 1×10^{-9}

Set the measuring time by referring to the error rate range shown above. When outputting the measured results to the printer or GP-IB, set the time as shown below.

Normal data: 10 seconds or more

TH ES, Error Performance data: one minute or more

2. BLOCK

This is used when the measuring time is set by clock count.

BLOCK is characterized by the fact that the measurable minimum error rate can be easily found from clock count.

Example:

Clock count = 10^8 bit --- Minimum error rate = 10^{-8}

The settable clock count is limited as follows by the measuring frequency.

Measuring frequency	Settable clock count
1 MHz to 10 MHz or less	10^6 to 10^9 bits
10 MHz to 50 MHz	10^7 to 10^9 bits

The following equation shows the relationship between the clock count and the measuring time.

$$\text{Measuring time} = \frac{\text{Clock count}}{\text{Frequency (Hz)}}$$

Example:

Frequency = 44.736 MHz,
Clock count = 10^8 bits

$$\text{Measuring time} = \frac{10^8}{44.736 \times 10^6} \cong 2.2 \text{ seconds}$$

When the measuring time is set by clock count, the measurement items are only ERROR RATE and ERROR COUNT.

TIME DISPLAY:

TIMED: This is used to display the remaining measuring time.

ELAPSED: This is used to display the elapsed measuring time.

MODE:

SINGLE: This is used when measuring is made once.

REPEAT: This is used when measurement is made repeatedly.

UNTIMED: This is used when measurement is made without setting the measuring time in advance.

PAUSE/CONT: OFF (CONT)

JITTER: (Option 02) Usually set to OFF

PRINT: (Option 11) Usually set to OFF

Turn it ON to print out the measured result.

For details, refer to paragraph 3.2.5.

3.3.3 Measurement example

Set the transmitter and receiver according to paragraph 3.3.2.

The following explanation describes examples of each measurement.

(1) DS-3 system measurement (off-line)

(a) Setup

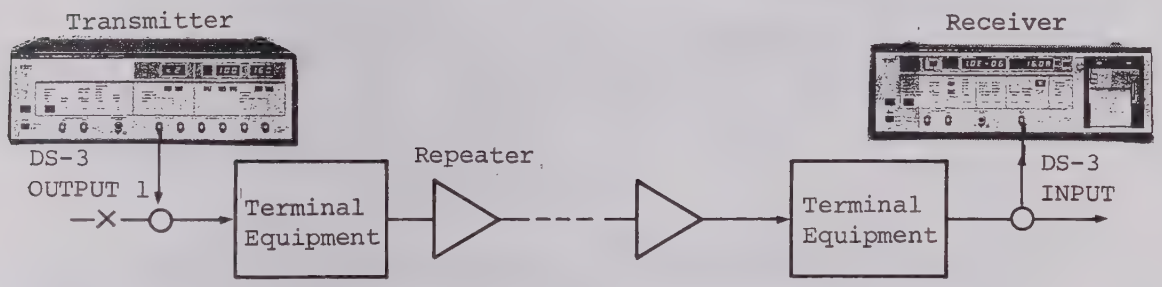


Fig. 3-14 Setup

(b) Transmitter settings

CLOCK : DS-3

FRAME : FRAMED

PATTERN : PRBS

DS-3 LEVEL : DSX-3

ERROR ADDITION: OFF

JITTER MODULATION : OFF

(c) Receiver settings

INPUT	: DSX-3 H/L
FRAME	: FRAMED
DEMUX	: OFF
PATTERN	: PRBS
MEASUREMENT DISPLAY	: ER RATE
ERROR	: BIT
TIME DISPLAY	: TIMED (Set measuring time to 10 seconds.)
TIME MODE	: REPEAT
PAUSE/CONT	: CONT
START/STOP	: START
JITTER	: OFF
BUZZER	: OFF
PRINT	: OFF

(d) Measurement

The bit error of the line is measured. The measured results are displayed every 10 seconds. The error rate measurement range of this setting is approx. 2.2×10^{-9} to 1.0×10^{-1}.

(2) DS-3 system measurement (on-line)

(a) Setup

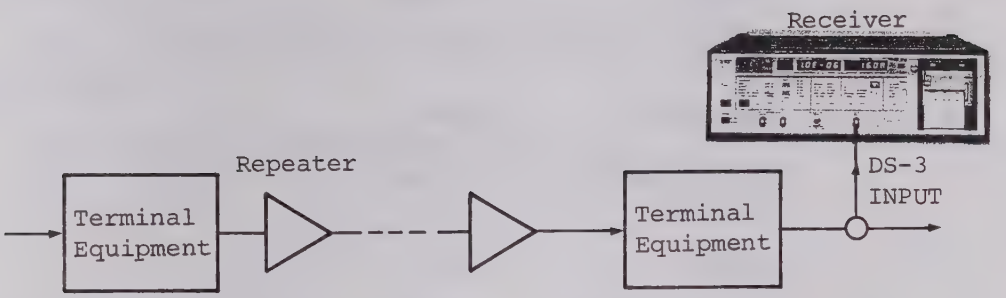


Fig. 3-15 Setup

(b) Receiver settings

INPUT	: DSX-3 H/L
FRAME	: FRAMED
DEMUX	: OFF
PATTERN	: LIVE
MEASUREMENT DISPLAY	: ER RATE
ERROR	: PARITY ERROR or FRAME ERROR
TIME DISPLAY	: TIMED (Set the measuring time to 10 seconds.)
TIME MODE	: REPEAT
PAUSE/CONT	: CONT
START/STOP	: START
JITTER	: OFF
BUZZER	: OFF
PRINT	: OFF

(c) Measurement

The parity error or frame error of the signal in service is measured. The measured results are displayed every 10 seconds. The error rate measurement range at this setting is approx. 2.2 x 10^{-9} to 2.0 x 10^{-4} for parity error and approx. 3.8 x 10^{-7} to 1.0 x 10^{-1} for frame error.

(3) M13 MUX measurement

(a) Setup

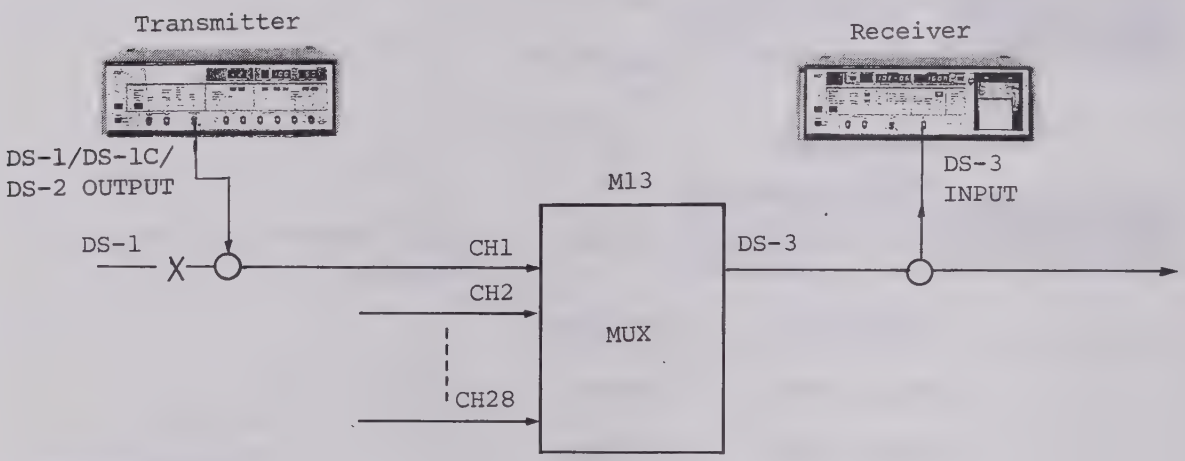


Fig. 3-16 Setup

(b) Transmitter settings

CLOCK : DS-1

DS-1 CODE : AMI or B8ZS (Set to the code of the MUX to be measured)

FRAME : D4 or ESF (Set to the frame of the MUX to be measured)

PATTERN : PRBS

ERROR ADDITION: OFF

JITTER MODULATION : OFF

(c) Receiver settings

INPUT : DSX-3 H/L

FRAME : D4 or ESF (Set to the frame of MUX to be measured)

DEMUX : ON

DS-1 CHANNEL : CH1

PATTERN : PRBS

MEASUREMENT DISPLAY : ER RATE

MEASUREMENT ERROR : BIT

TIME DISPLAY : TIMED (Set the measuring time to 10 seconds.)

TIME MODE : REPEAT

PAUSE/CONT : CONT

START/STOP : START

JITTER : OFF

BUZZER : OFF

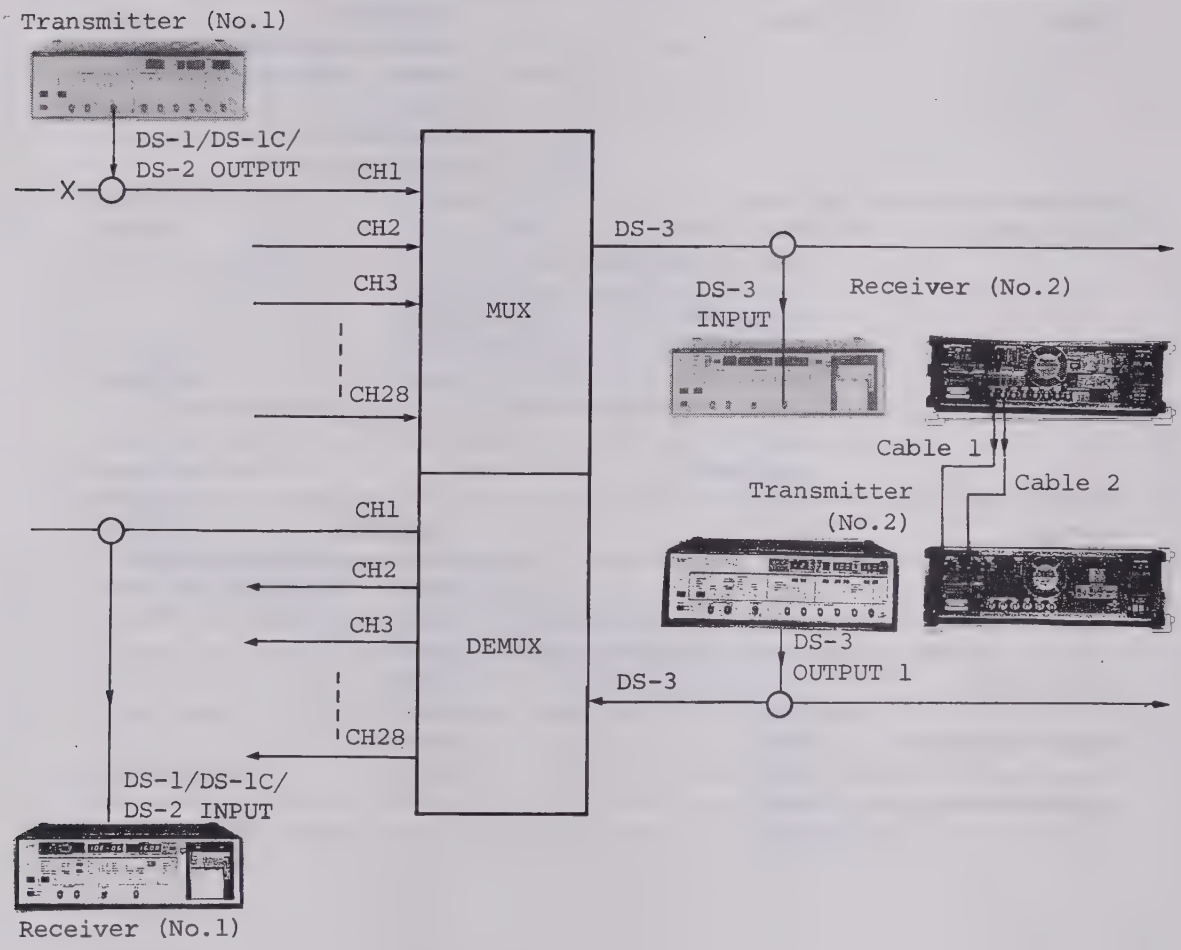
PRINT : OFF

(d) Measurement

The MUX bit error is measured. The measurement results are displayed every 10 seconds. The error rate measurement range at this setting is approx. 6.5×10^{-8} to 1.0×10^{-1}.

(4) M13 DEMUX measurement

(a) Setup



Rear panel connection

Receiver (No.2)		Transmitter (No.2)
MONITOR OUTPUT CLOCK	Cable 1 ⟷	EXTERNAL CLOCK INPUT
MONITOR OUTPUT DATA	Cable 2 ⟷	EXTERNAL DATA INPUT

Use cables of the same length for 1 and 2.

Fig. 3-17 Setup

(b) Transmitter settings

Label	Transmitter No.1	Transmitter No.2
CLOCK	DS-1	EXTERNAL Set the EXTERNAL CLOCK INPUT LEVEL switch on the rear panel to TTL and set the FUNCTION SWITCH A1 and A2 to "0".
DS-1 CODE	AMI or B8ZS (Set to the code of the MUX to be measured.)	————————
FRAME	D4 or ESF (Set to the frame of the MUX to be measured.)	————————
PATTERN	PRBS	EXTERNAL Set the EXTERNAL DATA INPUT LEVEL switch on the rear panel to TTL.
DS-3 LEVEL	————————	DSX-3
ERROR ADDITION	OFF	OFF
JITTER MODULATION	OFF	OFF

(c) Receiver settings

Label	Receiver No.1	Receiver No.2
INPUT	DS-1	DSX-3 H/L
DS-1 CODE	AMI or B8ZS (Set to the cable of the MUX to be measured.)	————————
FRAME	D4 or ESF (Set to the frame of the MUX to be measured.)	UNFRAMED
PATTERN	PRBS	PRBS
MEASUREMENT DISPLAY	ER RATE	ER RATE
ERROR	BIT	BIT
TIME DISPLAY	TIMED (Set the measuring time to 10 seconds.)	TIMED (Set the measuring time to 10 seconds.)
TIME MODE	REPEAT	REPEAT
PAUSE/CONT	CONT	CONT
START/STOP	START	START
JITTER	OFF	OFF
BUZZER	OFF	OFF
PRINT	OFF	OFF

(d) Measurement

The MUX and DEMUX are measured using the two transmitter and receiver systems.

In this measurement, the transmitter cannot generate the signal for measuring DEMUX. (The DS-2 frame signal must be included in DS-3 signal to measure DEMUX. However, the transmission signal of the transmitter does not include this DS-2 frame signal.) A signal from MUX is used for measuring DEMUX.

Receiver No.2 is used to convert the signal (bipolar signal) from MUX to unipolar.

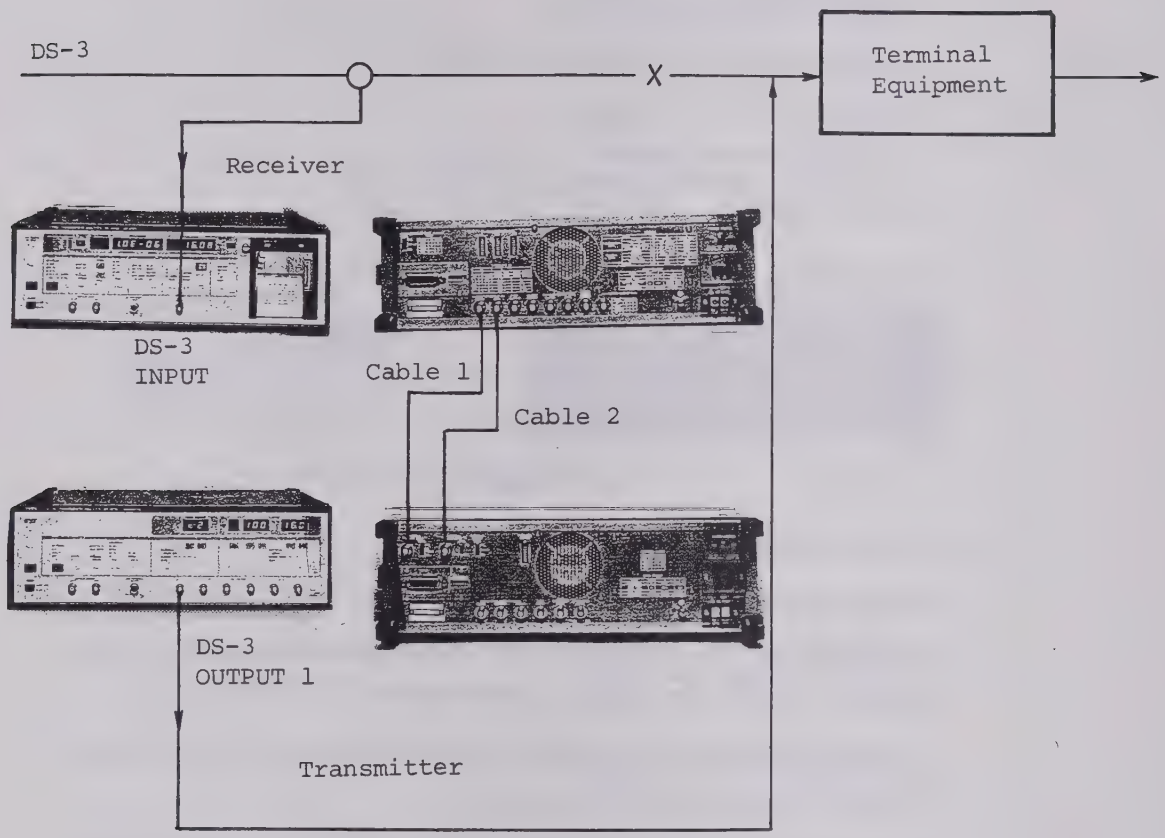
Receiver No.2 is also used to determine whether the error that occurs is due to MUX or DEMUX when it is generated in the other receiver No.1.

However, MUX and DEMUX cannot be measured simultaneously because receiver No.2 FRAME must be set to FRAMED at MUX measurement and to UNFRAMED at DEMUX measurement.

Transmitter No.2 can apply jitter modulation to the signal from receiver No.2.

(5) APS (Alarm Protection Switch) function test

(a) Setup



Rear panel connection

Receiver		Transmitter
MONITOR OUTPUT CLOCK	Cable 1 ⟷	EXTERNAL CLOCK INPUT
MONITOR OUTPUT DATA	Cable 2 ⟷	EXTERNAL DATA INPUT

Use cables of the same length for 1 and 2.

Fig. 3-18 Setup

(b) Transmitter settings

CLOCK : EXTERNAL

PATTERN : EXTERNAL

DS-3 LEVEL : DSX-3

ERROR ADDITION: ERROR RATE

JITTER : OFF

EXTERNAL CLOCK (rear panel): TTL
INPUT LEVEL

EXTERNAL DATA (rear panel) : TTL
INPUT LEVEL

(c) Receiver settings

INPUT : DSX-3 H/L

FRAME : UN FRAMED

(d) Measurement

The error detection function of the terminal equipment is checked by changing the error rate to be added in the transmitter.

Use EXTERNAL error addition MODE when the error rate is changed gradually.

The receiver is used to convert the DS-3 signal to the unipolar signal.

(6) Use of externally generated pattern

(a) Setup

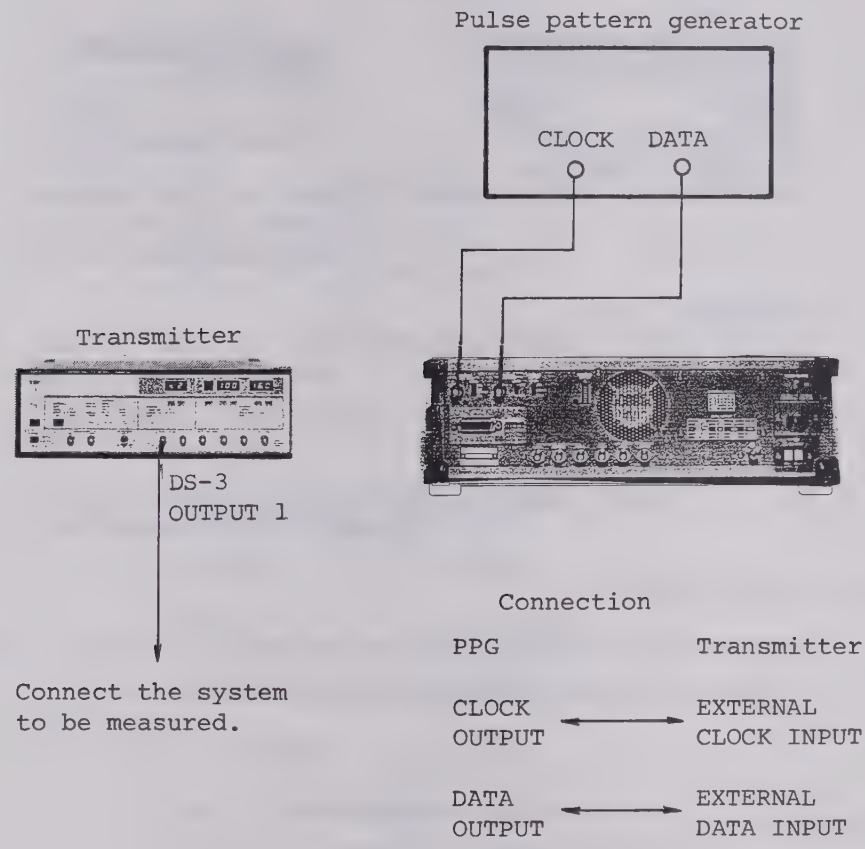


Fig. 3-19 Setup

(b) Transmitter settings

CLOCK : EXTERNAL

PATTERN : EXTERNAL

ERROR ADDITION: OFF

JITTER : OFF

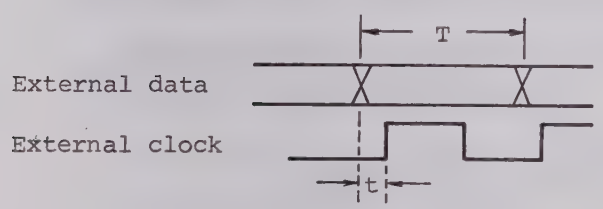
EXTERNAL CLOCK
INPUT LEVEL (Rear panel): Set to the output level of the pulse pattern generator.

EXTERNAL DATA
INPUT LEVEL (Rear panel): Set to the output level of the pulse pattern generator.

FUNCTION SWITCH
A1, A2 (Rear panel): Set to the clock of the system to be measured.

(c) Measurement

Use the external data and external clock in the following phase relationship.



$|t| \leqq$ (10% of T +1 ns)

Error addition and jitter modulation can be applied to the external data signal.

(7) Jitter immunity measurement (manual)

(a) Setup

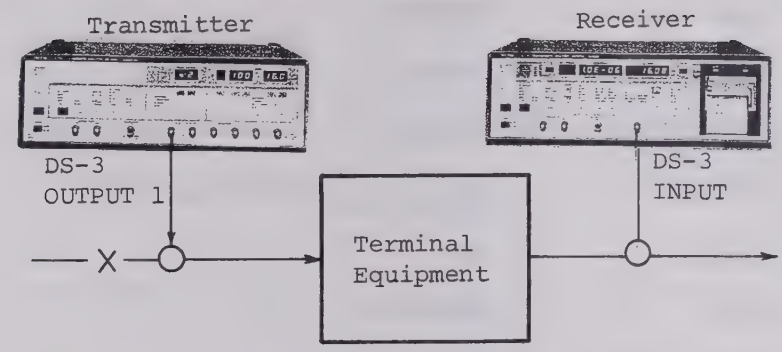


Fig. 3-20 Setup

(b) Transmitter settings

CLOCK	: DS-3
FRAME	: FRAMED
PATTERN	: PRBS
DS-3 LEVEL	: DSX-3
ERROR ADDITION	: OFF
JITTER MODULATION	: MANUAL

(c) Receiver settings

INPUT	: DSX-3 H/L
FRAME	: FRAMED
DEMUX	: OFF
PATTERN	: PRBS
MEASUREMENT DISPLAY	: ER RATE

ERROR : BIT

TIME DISPLAY : TIMED (Set measuring time to 1 second.)

TIME MODE : REPEAT

PAUSE/CONT : CONT

START/STOP : START

JITTER : ON (Set FILTER to OFF.)

BUZZER : ON

PRINT : OFF

TIME/JITTER DISPLAY : UIp-p

(d) Measurement

Manually change the jitter amplitude and the modulation signal frequency at the transmitter and measure the jitter immunity of the terminal equipment. The receiver JITTER display blinks until jitter synchronization is established.

Jitter synchronization requires approx. 10 seconds. When jitter of approx. 10 UIp-p or more is applied, increase the jitter amplitude after the jitter synchronization is established by reducing jitter amplitude to 2 to 3 UIp-p.

However, if only the error generation is checked by the receiver, the operation will not be affected even if the jitter is not synchronized. The applied jitter amplitude when an error is detected at the receiver is the jitter immunity of the terminal equipment.

When there are a few errors, it is more convenient to check the error generation by using BUZZER.

(8) Jitter immunity measurement (automatic)

(a) Setup

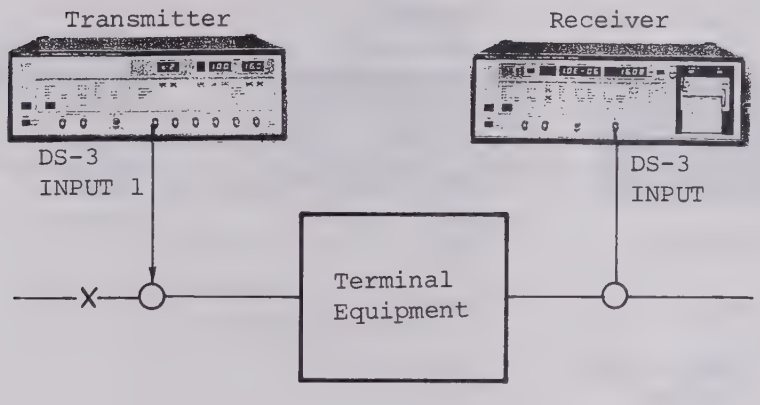


Fig. 3-21 Setup

(b) Transmitter settings

CLOCK	: DS-3
FRAME	: FRAMED
PATTERN	: PRBS
DS-3 LEVEL	: DSX-3
ERROR ADDITION	: OFF
JITTER MODULATION	: AUTO SWEEP

(c) Receiver settings

INPUT	: DSX-3 H/L
FRAME	: FRAMED
DEMUX	: OFF
PATTERN	: PRBS
MEASUREMENT DISPLAY	: ER RATE

ERROR : BIT

TIME DISPLAY : TIMED (Set the measuring time to 1 second.)

TIME MODE : REPEAT

PAUSE/CONT : CONT

START/STOP : START

JITTER : ON (Set FILTER to OFF.)

BUZZER : ON

PRINT : OFF

TIME/JITTER DISPLAY : UIp-p

(d) Measurement

In the AUTO SWEEP mode, the jitter immunity is measured while changing the jitter amplitude and modulation signal frequency automatically with the jitter mask. The AUTO SWEEP jitter mask contents are programmable. For the programming method, refer to Table 3-1 #11 in paragraph 3.2.1.

(9) Jitter amplitude measurement

(a) Setup

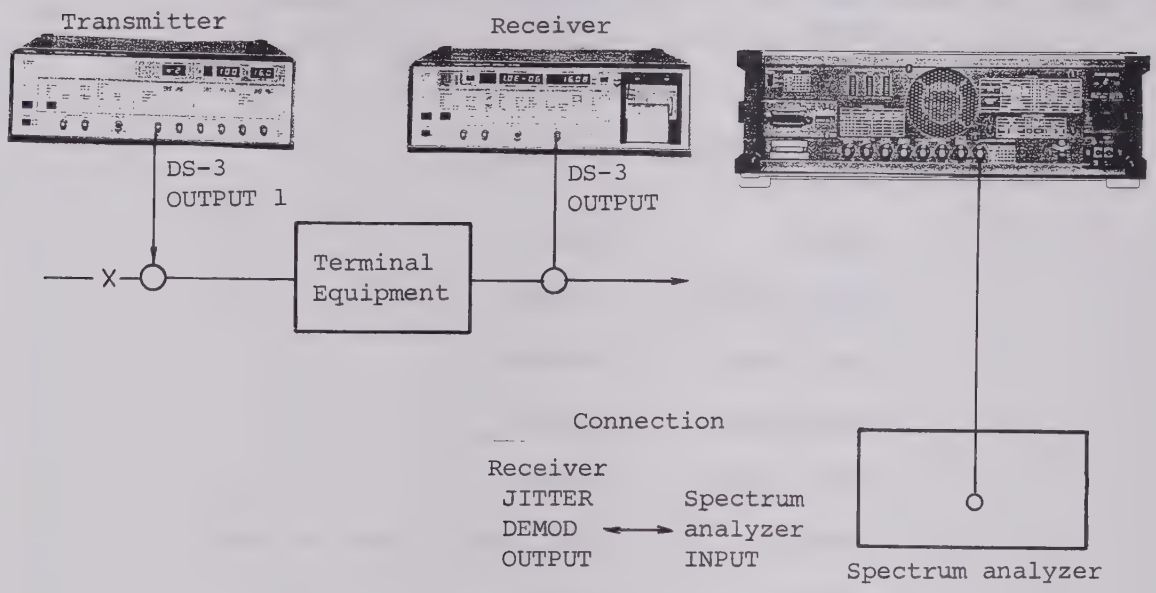


Fig. 3-22 Setup

(b) Transmitter settings

CLOCK : DS-3

FRAME : FRAMED

PATTERN : PRBS

DS-3 LEVEL : DSX-3

ERROR ADDITION: OFF

JITTER MODULATION : OFF

(c) Receiver settings

INPUT	: DSX-3 H/L
FRAME	: FRAMED
DEMUX	: OFF
PATTERN	: PRBS
MEASUREMENT DISPLAY	: ER RATE
ERROR	: BIT
TIME DISPLAY	: TIMED
TIME MODE	: REPEAT
PAUSE/CONT	: CONT
START/STOP	: START
JITTER	: ON (Set FILTER to OFF.)
BUZZER	: OFF
PRINT	: OFF
TIME JITTER DISPLAY	: UIp-p

(d) Measurement

The receiver calibrates the clock regeneration circuit for the jitter amplitude measurement each time the INPUT bit rate is switched. Therefore, it is advisable to switch the INPUT bit once before starting jitter amplitude measurement.

Example:

DSX-3 → DS-3 → DS-2 → --- → DSX-3

The switching time in each step is arbitrary.

The receiver JITTER display blinks until the jitter synchronization is established. Jitter synchronization requires approx. 10 seconds.

Connect JITTER DEMOD OUTPUT on the receiver rear panel to the spectrum analyzer to check the jitter frequency component.

SECTION 4

PRINCIPLES OF OPERATION

4.1 Transmitter

Figure 4-1 shows the transmitter block diagram.

The transmitter generates the clock signal and pattern, and outputs them after code conversion and waveform shaping.

The clock signal has four internal clocks (44.736, 6.312, 3.152, and 1.544 MHz) and one external clock (1 to 50 MHz).

The CLOCK GENERATOR circuit generates four internal clocks and selects one clock signal from four internal clocks and one external clock signal.

The selected clock signal enters the PATTERN/FRAME GENERATOR circuit and generates a pattern (PRBS, 1111, 1100, 1010, 1000) and frame corresponding to each bit rate.

The ERROR ADDITION circuit divides the clock signal, generates an error pulse and adds a 1-bit error to the NRZ signal. For an external error, a 1-bit error or burst error is added.

The UNIPOLAR OUTPUT circuit shapes the waveform of the NRZ pattern signal and clock signal and outputs them after level conversion (TTL, +/-1 V, or ECL). The number of outputs is one system for each clock signal and data signal.

The DS-1/DS-1C/DS-2 signal output to one balanced output connector.

The CODE CONVERTER circuit converts the NRZ pattern signal to the signal that has the code corresponding to each bit rate (B3ZS for DS-3, B6ZS for DS-2, and B8ZS for DS-1) and branches the converted signal into + and - routes.

The UNIPOLAR to BIPOLAR CONVERTER circuit converts the branched NRZ signal to the RZ signal and bipolar signal, and output the converted signal. The DS-3 signal outputs to six unbalanced output connectors. For each output, the phase is delayed by 3 bits in order No.1 to No.6 in the DELAY circuit.

The JITTER MODULATION circuit is composed of a jitter modulation circuit and jitter modulation signal generation circuit. The jitter modulation signal generation circuit generates the jitter modulation signal (2 Hz to 300 kHz sine wave). The jitter modulation signal can be selected between internal and external by a key.

The jitter modulation circuit receives each bit rate clock signal and the jitter modulation signal and applies phase modulation to the clock signal.

The CONTROLLER circuit controls the front panel keys, display, each circuit, and the GP-IB or RS-232C interface.

The synchronizing outputs are clock, pattern, and frame. The X-BIT input signal sets the frame signal (DS-3, DS-2, and DS-1C) X-BIT in the PATTERN/FRAME GENERATOR circuit.

The EXTERNAL DATA signal is used with the EXTERNAL CLOCK signal. An error and jitter modulation can be added to the EXTERNAL DATA signal.

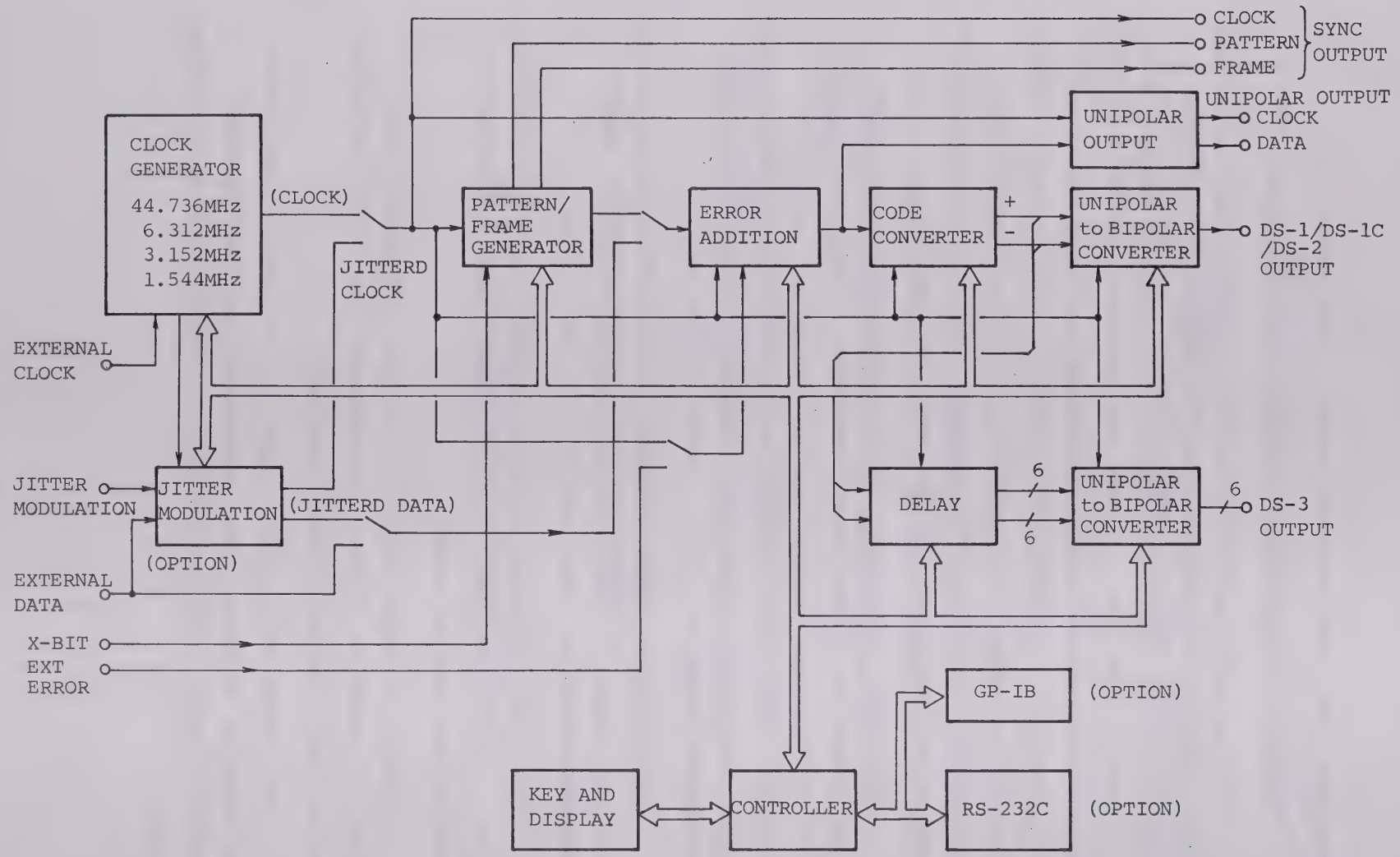


Fig. 4-1 Transmitter Block Diagram

4.2 Receiver

Figure 4-2 shows the receiver block diagram.

The receiver receives the data signal from the system to be measured and the waveform is shaped in the INPUT circuit to the prescribed level. The bipolar signal (DS-3, DS-2, DS-1C, and DS-1) errors are detected by conversion to the unipolar signal, clock recovery, and comparison with the pattern in the ERROR DET circuit. The unipolar signal waveform is shaped in the INPUT circuit and errors are detected in the ERROR DET circuit. The detected errors are counted and displayed as the measured results.

Four input circuits (DS-3, DS-1/DS-1C/DS-2, CLOCK, DATA) shape the input signal waveform. The DS-3 and DS-1/DS-1C/DS-2 signal levels are kept constant in the AGC circuit. The bipolar signal is converted into the unipolar signal and input to the CODE CONVERTER circuit and CLOCK RECOVERY circuit.

The unipolar signal enters the ERROR DET circuit after waveform shaping. The unipolar signal skips the CODE CONVERTER circuit.

The CODE CONVERTER circuit converts signal with B3ZS, B6ZS, or B6ZS code into signal without code and also detects the bipolar error.

Since the CLOCK RECOVERY circuit recovered clock signal is used for jitter measurement, the CLOCK RECOVERY circuit has a large jitter tolerance.

The ERROR DET circuit makes a bit-by-bit comparison and detects an error after synchronizing the standard pattern signal generated internally with the input pattern signal.

The FRAME SYNC circuit synchronizes the input signal frame and detects the frame error, parity error, and CRC-6 error.

When the [DEMUX] key is on, one DS-1 channel signal (CH1 to CH28) in the DS-3 signal is picked up in the FRAME SYNC circuit.

The picked up DS-1 signal (clock, and data) is output.

The five detected errors (bit error, frame error, parity error, CRC-6 error, and bipolar error) are counted individually in the MEASUREMENT circuit and converted into the various formats such as error rate and error count.

The measured results are sent to the DISPLAY and PRINTER circuit.

The input signal is output as one clock signal and data signal.

The JITTER MEASUREMENT circuit measures the jitter amplitude from the input clock signal (including the clock signal recovered from the data signal).

The CONTROLLER circuit controls the front panel keys, display, each circuit, the GP-IB or RS-232C interface, and the printer, and analyzes the measured error.

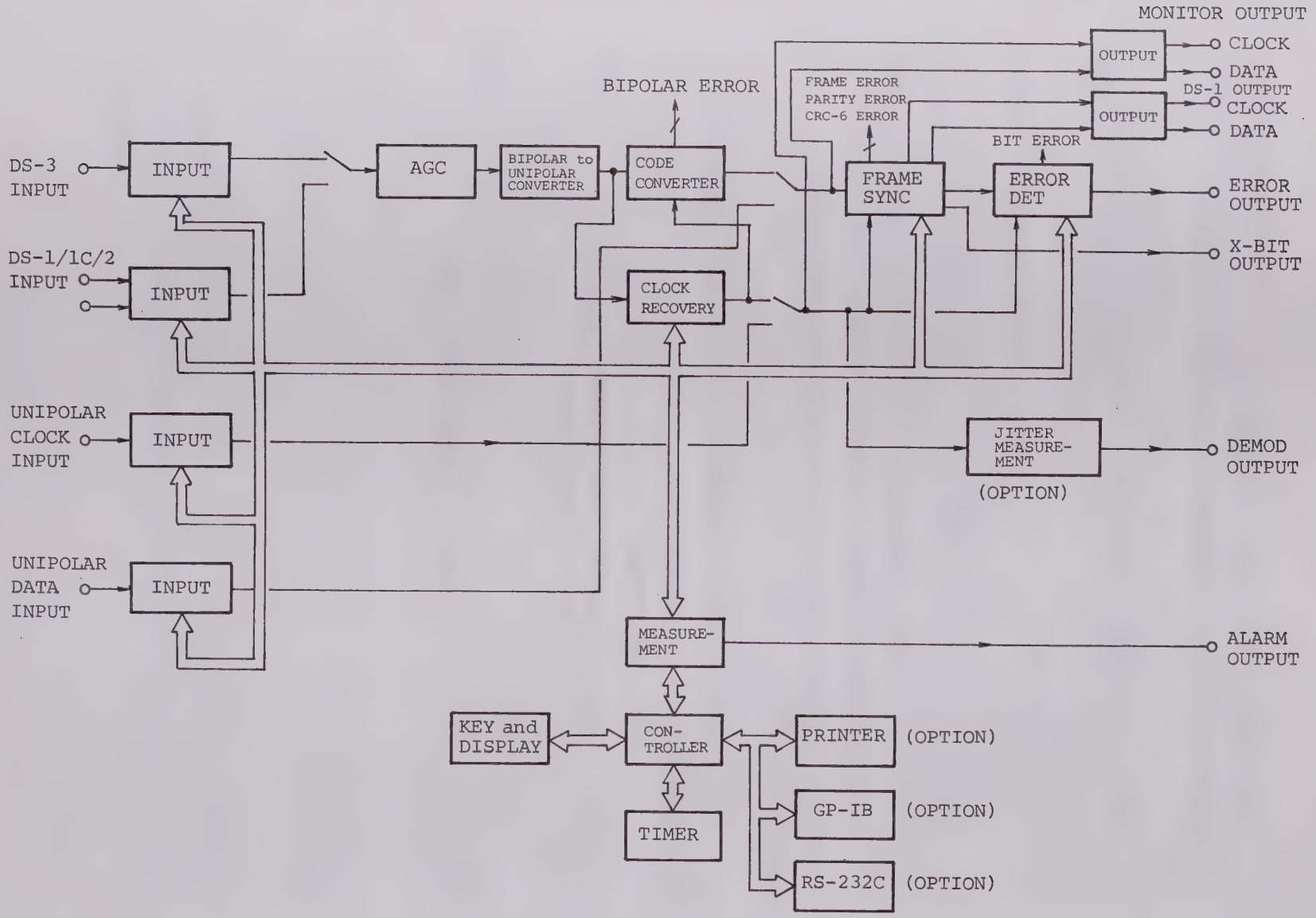


Fig. 4-2 Receiver Block Diagram

SECTION 5

EXPLANATION OF FUNCTIONS

5.1 Transmitter

(1) CLOCK

When CLOCK is set, PRBS, FRAME, and BIPOLAR CODE are automatically set.

Table 5-1 CLOCK, PRBS, FRAME, and BIPOLAR CODE Relationship

CLOCK	PRBS	FRAME	BIPOLAR CODE
DS-3	2^{15}-1 or 2^{23}-1 This is selected using FUNCTION SWITCH A3 on the rear panel.	DS-3 FRAME	B3ZS When PATTERN is 1000, this is set to AMI using the FUNCTION SWITCH A4 on the rear panel.
DS-2	2^{20}-1	DS-2 FRAME	B6ZS
DS-1C	2^{20}-1 (with 14 zero constraint.)	DS-1C FRAME	AMI
DS-1	2^{20}-1 (with 14 zero constraint.)	D4 or ESF This is selected using the [FRAME] key.	AMI or B8ZS This is selected using the [DS-1 CODE] key.
EXTERNAL	This is set using FUNCTION SWITCH A1 and A2 on the rear panel.		

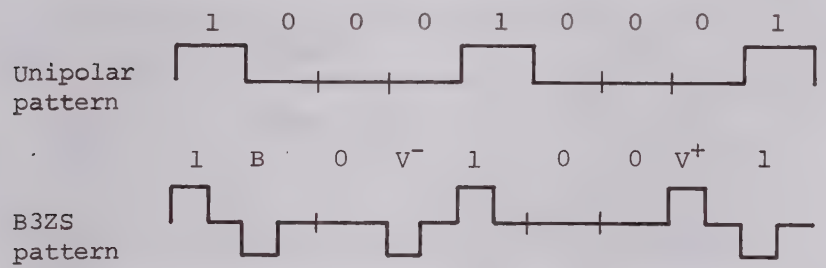
(2) CODE (B3Z3, B6ZS, and B8ZS)

(a) B3ZS

B3ZS code conversion rule

1. 3-bit continuous "0" pattern is converted to "BOV" or "00V".
2. The choice of BOV or 00V is made so that the polarity of V alternates between + and -.

Figure 5-1 shows a B3ZS code-conversion example.



B: bipolar rule bit

V: bipolar rule violation bit

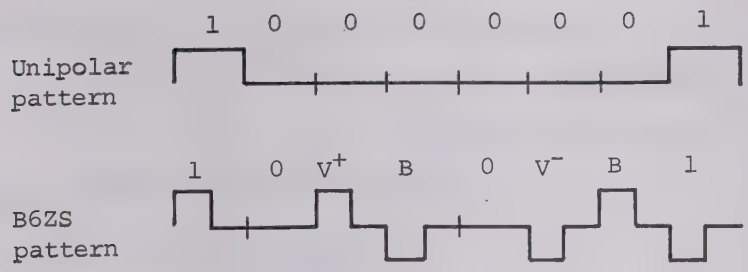
Fig. 5-1 B3ZS Code Conversion Example

(b) B6ZS

B6ZS code conversion rule

1. 6-bit continuous "0" pattern is converted to "0VB0VB".

Figure 5-2 shows a B6ZS code-conversion example.



B: bipolar rule bit

V: bipolar rule violation bit

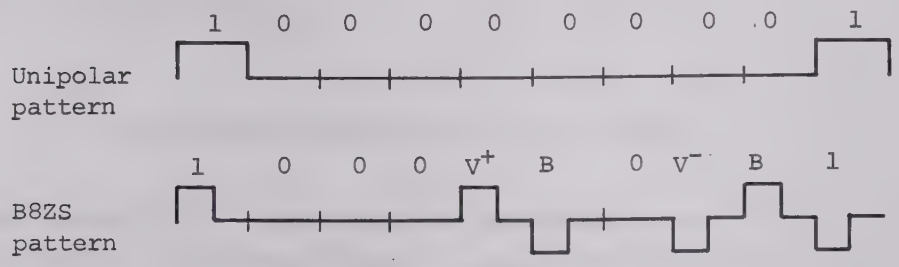
Fig. 5-2 B6ZS Code Conversion Example

(c) B8ZS

B8ZS code conversion rule

1. Convert 8-bit continuous "0" pattern is converted to "000VB0VB".

Figure 5-3 shows a B8ZS code-conversion example.



B: bipolar rule bit

V: bipolar rule violation bit

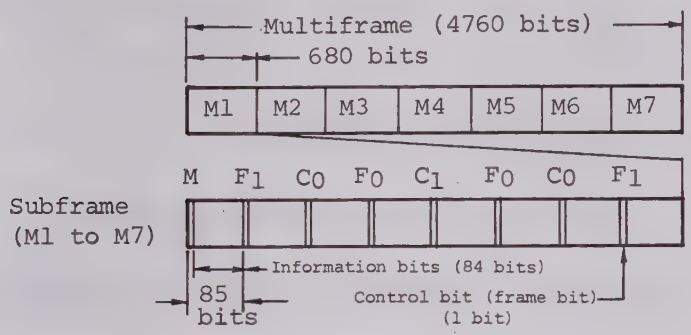
Fig. 5-3 B8ZS Code Conversion Example

(3) FRAME

A frame that complies with the Bell Standard is generated.

(a) DS-3 frame

Figure 5-4 shows the DS-3 frame composition.



M bits of M1 and M2: x-bit

M bits of M3 and M4: Parity bit

M bits of M5, M6, and M7 : Multiframe alignment signal M5M6M7 = 010

F1 F0 F0 F1 bits : Frame alignment signal F1F0F0F1 = 1001

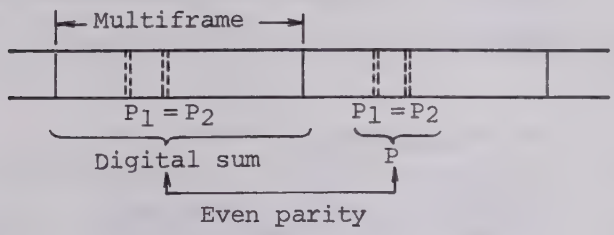
C0 C1 C0 bits : The ME3401A service bit C0C1C0 = 010

Fig. 5-4 DS-3 Frame Composition

A multiframe consists of 7 subframes, each of which has 8 blocks. Each block has a 1-bit control bit and 84-bit information bits.

The X-BIT is usually (1,1) but can be changed by adding an external signal to the X-BIT INPUT connector on the rear panel.

Figure 5-5 shows the parity bit.



Digital sum;

For the total number of "1" is even:
digital sum = 0

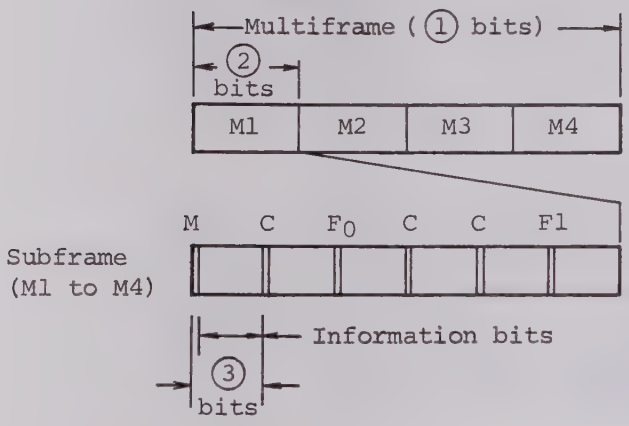
For the total number of "1" is odd:
digital sum = 1

Fig. 5-5 Parity Bit

If the digital sum of all information bits (4704 bits) in the previous multiframe is 1, P=11. If the same digital sum is 0, P=00.

(b) DS-2/DS-1C frame

Figure 5-6 shows the DS-2/DS-1C frame composition.



	①	②	③
DS-2	1176	294	49
DS-1C	1272	318	53

M bits of M4 : X-bit

M bits of M1, M2 and M3 : Multiframe alignment signal
M1M2M3 = 011

F0 F1 bits : Frame alignment signal
F0F1 = 01

C bits : The ME3401A service bit is set to "0".

Fig. 5-6 DS-2/DS-1C Frame Composition

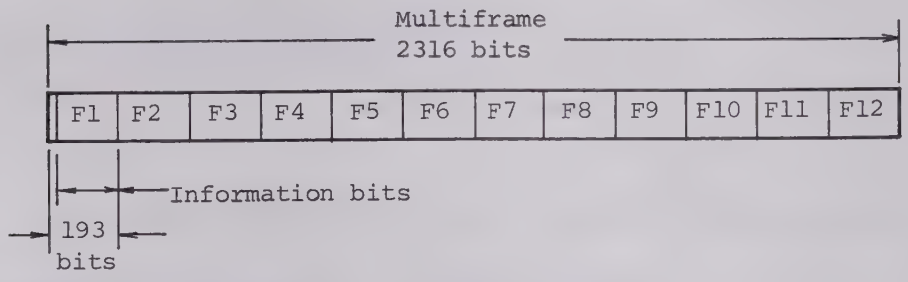
The multiframe is composed of four subframes and each subframe is composed of six blocks. Each block is composed of 49 bits for DS-2 and 53 bits for DS-1C; the leading 1 bit is the frame bit and the rest are information bits.

The X-bit is usually set to "1", but it can be changed by applying an external signal to the X-BIT INPUT connector on the rear panel.

(c) DS-1 frame

(i) D4 frame

Figure 5-7 shows the D4 frame composition.



F2, F4, F6, F8,
F10 bits : Multiframe alignment signal
F2F4F6F8F10 = 00111

F12 bits : S bit

F1, F3, F5, F7,
F9, F11 bits : Frame alignment signal
F1F3F5F7F9F11 = 101010

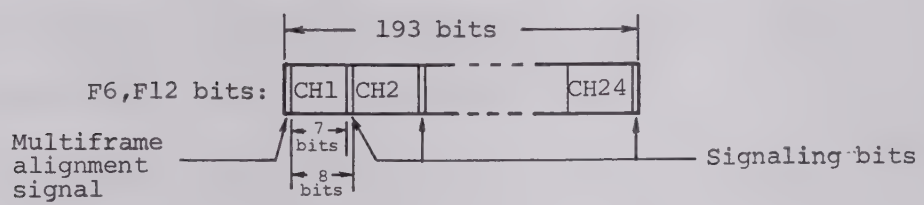
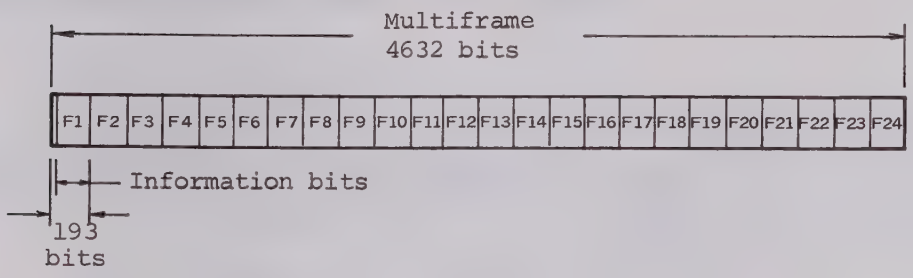


Fig. 5-7 D4 (DS-1) Frame Composition

One multiframe is composed of 12 frames. One frame is composed of 193 bits; the leading 1 bit of each frame is the frame bit and the rest are information bits. The 8th bit of CH1 to CH24 of F6 and F12 is the signaling bit. S bit is usually set to "0".

(ii) ESF frame

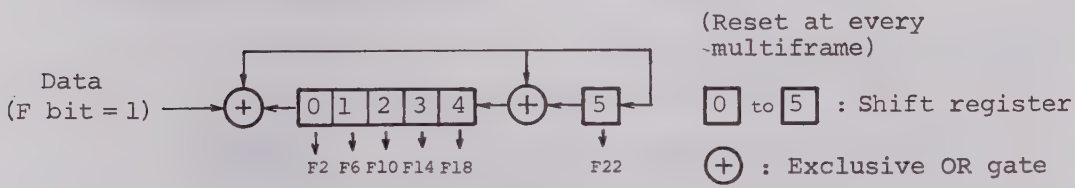
Figure 5-8 shows the ESF frame composition.


Multiframe
4632 bits
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12 F13 F14 F15 F16 F17 F18 F19 F20 F21 F22 F23 F24
Information bits
193
bits

F4, F8, F12, F16,
F20, F24, bits : Multiframe alignment signal
F4F8F12F16F20F24 = 001011

F1, F3, F5, F7, F9,
F11, F13, F15, F17,
F19, F21, F23 bits: 4 k Data Link

F2, F6, F10, F14,
F18, F22 bits : CRC-6



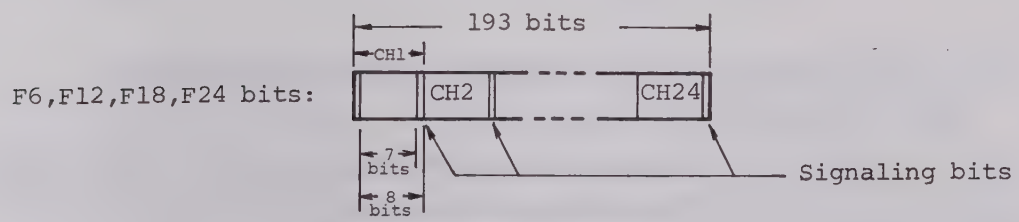


Fig. 5-8 ESF (DS-1) Frame Composition

One multiframe is composed of 24 frames. One frame is composed of 193 bits; the leading 1 bit of each frame is the frame bit and the rest are information bits. The 8th bit of CH1 to CH24 of F6, F12, F18 and F24 is the signaling bit.

(4) PATTERN

(a) PRBS

The ME3401A generates four pseudorandom patterns:

PRBS 2^{15}-1: 32,767 bits/period

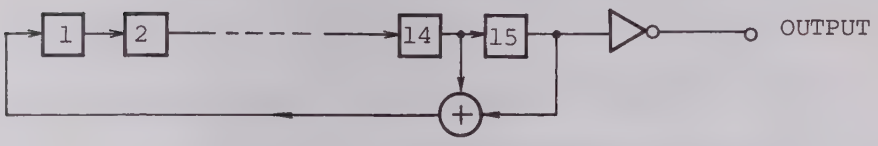
PRBS 2^{20}-1: 1,048,575 bits/period

PRBS 2^{20}-1: 1,048,575 bits (with 14 zero constraint/period)

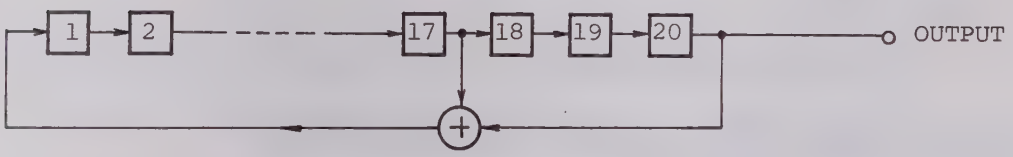
PRBS 2^{23}-1: 8,388,607 bits/period

Figure 5-9 shows the PRBS pattern generation method.

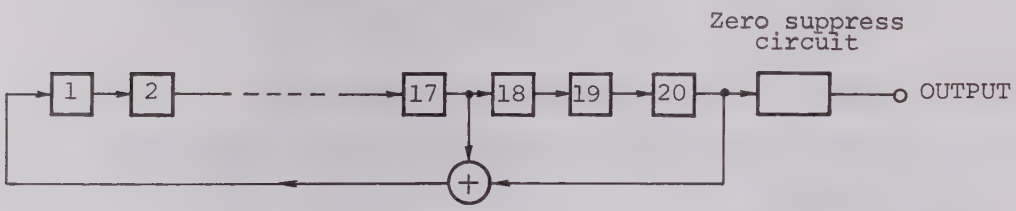
PRBS 2^{15}-1: In accordance with CCITT Rec. O.151



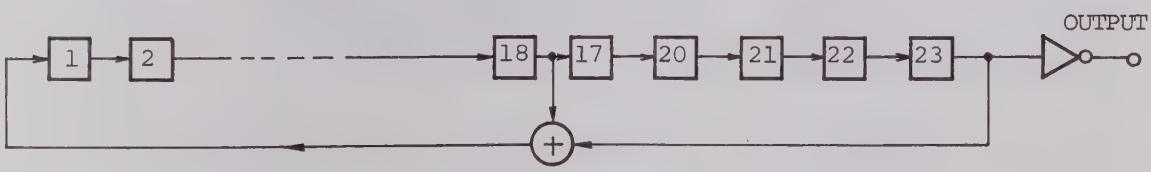
PRBS 2^{20}-1:



PRBS 2^{20}-1: With 14 zero constraint



PRBS 2^{23}-1: In accordance with CCITT Rec. O.151



□ Shift register

▷o Inverter

⊕ Exclusive OR gate

Fig. 5-9 PRBS Pattern Generation Method

(5) Error addition

There are two types of error addition method: internal error addition and external error addition. A 1-bit error is added periodically by using the internal error addition method.

The external error addition method is used to add an error at an arbitrary error rate or to add a burst error. Figure 5-10 shows the error addition.

The SIGNAL error adds a 1-bit error at every external error signal rise.

The BURST error adds errors when the external error signal is low level.

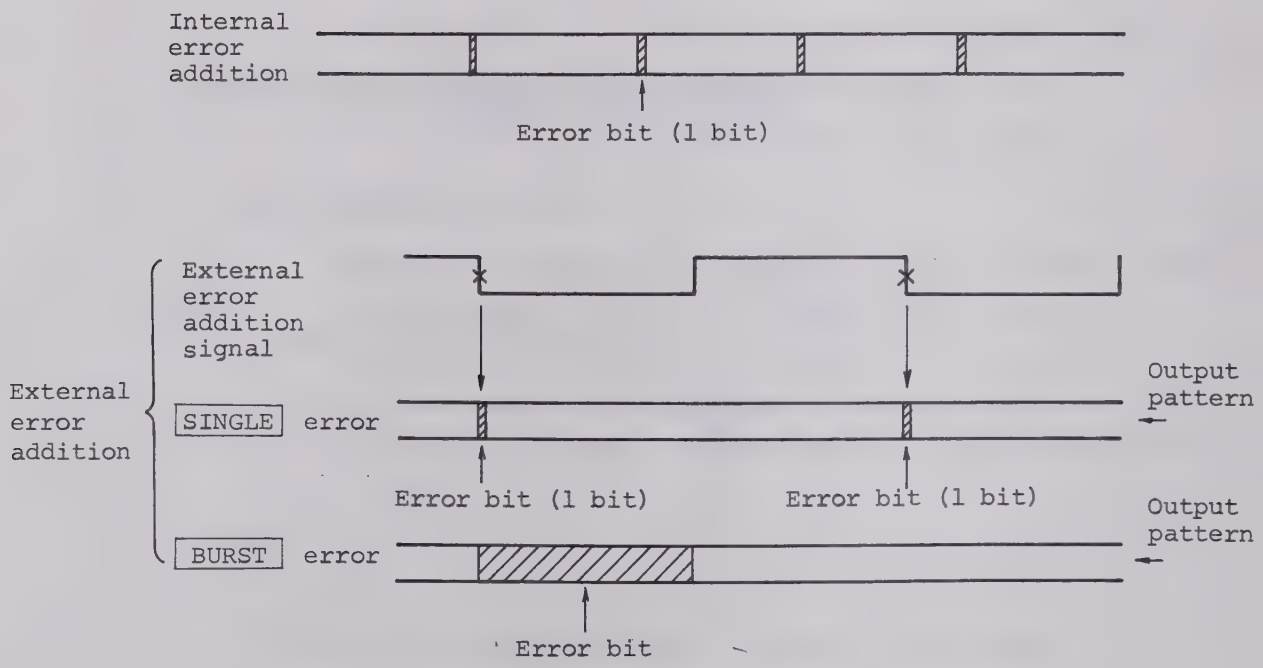


Fig. 5-10 Error Addition

(6) DS-3 LEVEL

Figure 5-11 shows the level at the test points.

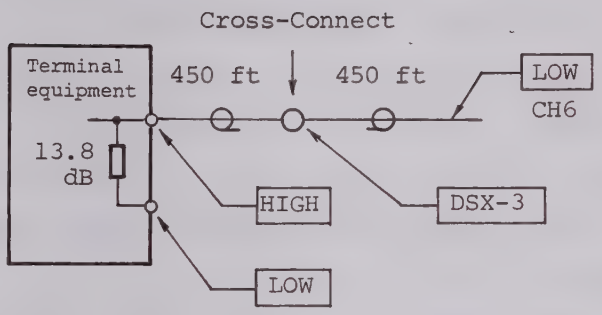


Fig. 5-11 Test Point Levels

(7) Unipolar output

Figure 5-12 shows the unipolar output circuit when the level is ECL.

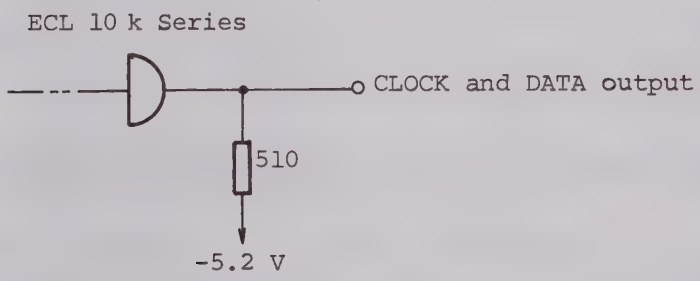


Fig. 5-12 Unipolar Output Circuit (ECL Level)

5.2 Receiver

(1) INPUT

(a) DS-3 LEVEL

Figure 5-13 shows the relationship between the test point in DS-3 and the receiver input level.

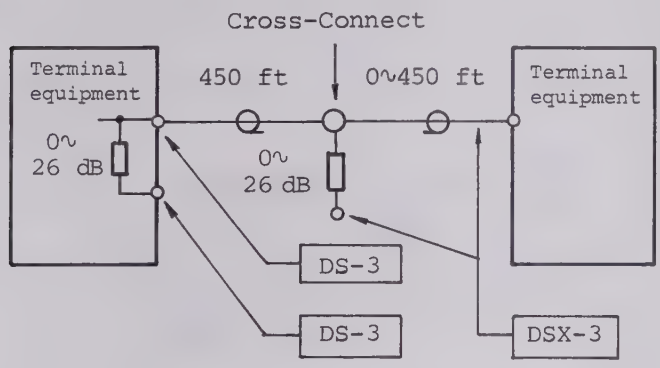


Fig. 5-13 Relationship between Test Point and Receiver Input Level

(b) Unipolar input

Figure 5-14 shows the input circuit for ECL level input signal. The ECL input circuit has 100 Ω connected to GND and 301 Ω to -5.2 V. Use a circuit equivalent to that shown in Fig. 5-12 for the output circuit of the system to be measured.

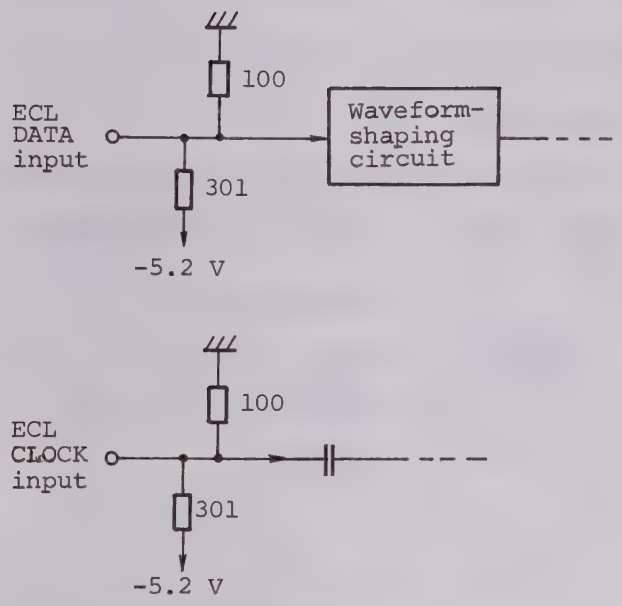


Fig. 5-14 ECL Input Circuit

(2) Error detection

(a) Bit error

The bit error is detected as in Fig. 5-15.

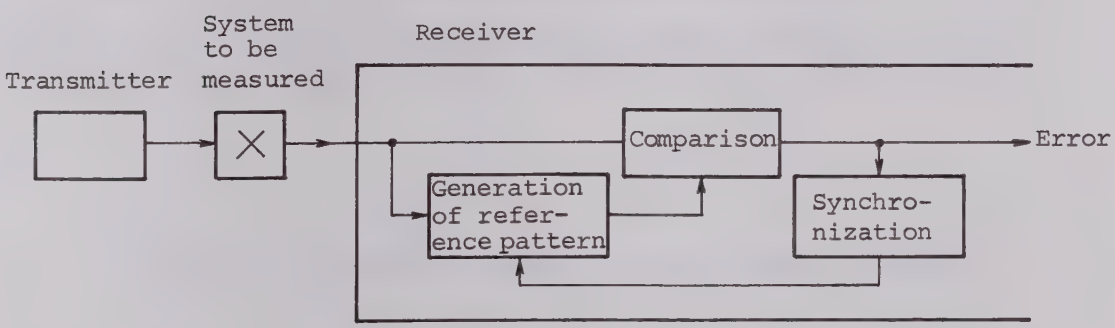


Fig. 5-15 Bit Error Detection

In the receiver, an error is detected by comparing the input pattern with the pattern generated in the receiver (same pattern as in the transmitter) bit-by-bit.

(b) Parity error

The parity error is measured at input of the DS-3 signal and when the [FRAME] key is on.

Figure 5-16 shows the parity error detection method.

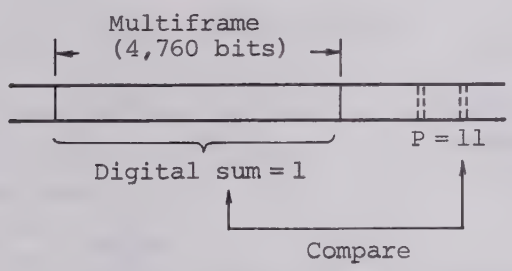


Fig. 5-16 Parity Error

An error is detected by comparing the digital sum of the previous multiframe with the following multiframe parity bit.

Since only one parity error can be detected in one multiframe (4760 bits), the maximum error rate of the parity error is 1/4760 bits $\cong$ 2.1 x 10^{-4}.

The parity error is characterized by the fact that an error cannot be detected if there is an even number of errors in one multiframe. The parity error is used to evaluate the line in service.

(c) Frame error

The frame error is detected only for the frame bit (except for the multiframe). It is used to evaluate the line in service similarly to the parity error.

(d) Bipolar error

Figure 5-17 shows the DS-3 bipolar error detection method.

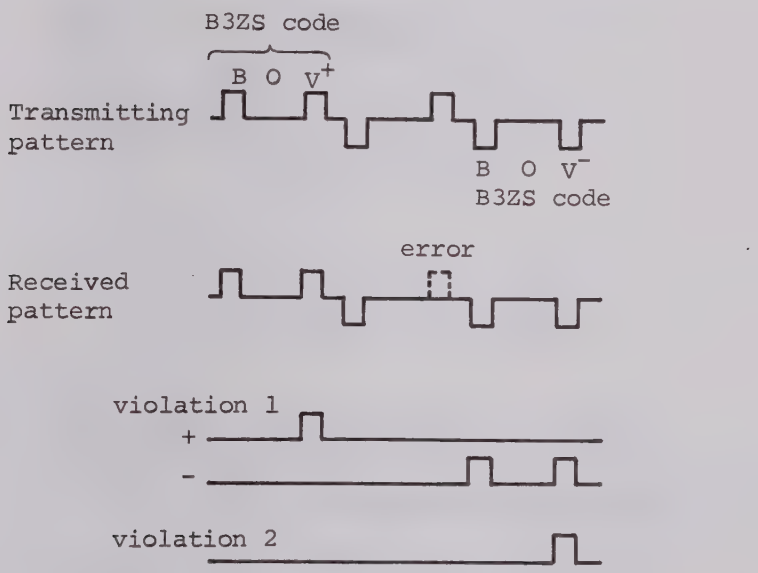


Fig. 5-17 Bipolar Error

The bipolar error is used to evaluate the line in service.

(e) CRC-6 error

The CRC-6 error can be measured when the FRAME is ESF (DS-1). It is detected by comparing the CRC calculated value of the previous frame with the CRC-6 bit value in the following frame.

Since only one CRC-6 error can be detected in one frame (4632 bits), the maximum CRC-6 error rate is $1/4632 \cong 2.1 \times 10^{-4}$.

(3) Measurement item

(a) Error rate

Definition:

$$\text{Error rate} = \frac{\text{Number of error pulse (K in Fig. 5-18)}}{\text{Number of clocks within measuring time (N in Fig. 5-18)}}$$

Measuring range: 9.9×10^{-2} to 1.0×10^{-15}

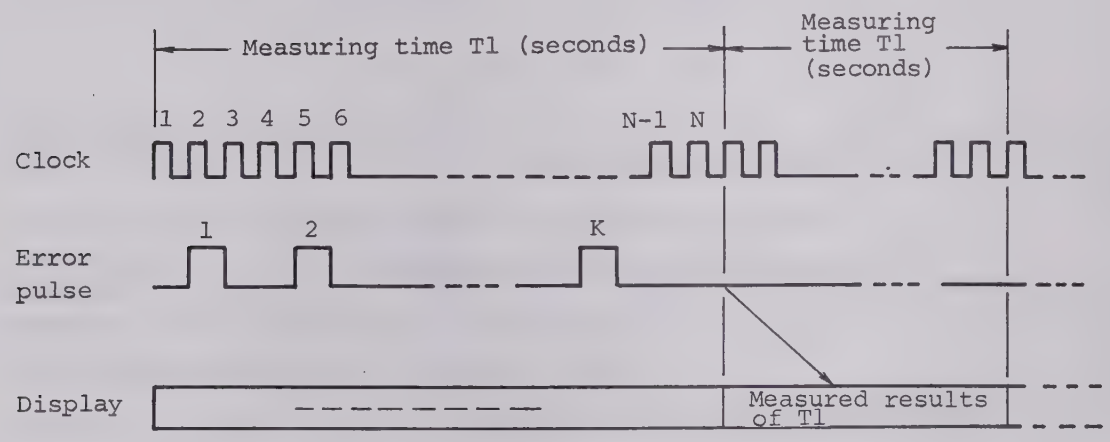


Fig. 5-18 Error Rate

(b) Error count

Definition: Number of error pulses within the measuring time (K in Fig. 5-19)

Measuring range: 1 to 99999, 1×10^5 to 9.9×10^{15}

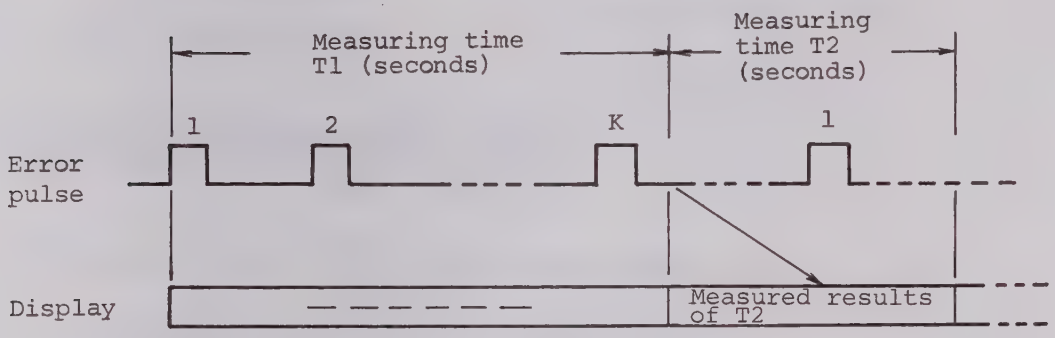


Fig. 5-19 Error Count

(c) Error seconds (ES)

When the measuring time is set by BLOCK, error seconds cannot be measured.

Definition: Number of seconds with one or more error pulses within the measuring time

Measuring range: 1 to 99999, 1×10^5 to $9.9\ 10^9$

Figure 5-20 shows error seconds. There are two types of error seconds: synchronous and asynchronous.

They can be set using FUNCTION SWITCH C on the rear panel.

C1 = 1: Synchronous

C1 = 0: Asynchronous

Synchronous error seconds:

One second after one error occurs is an error second.

Asynchronous error seconds:

The measuring time is divided into 1 second periods and if an error pulse occurs in 1 second, it is an error second.

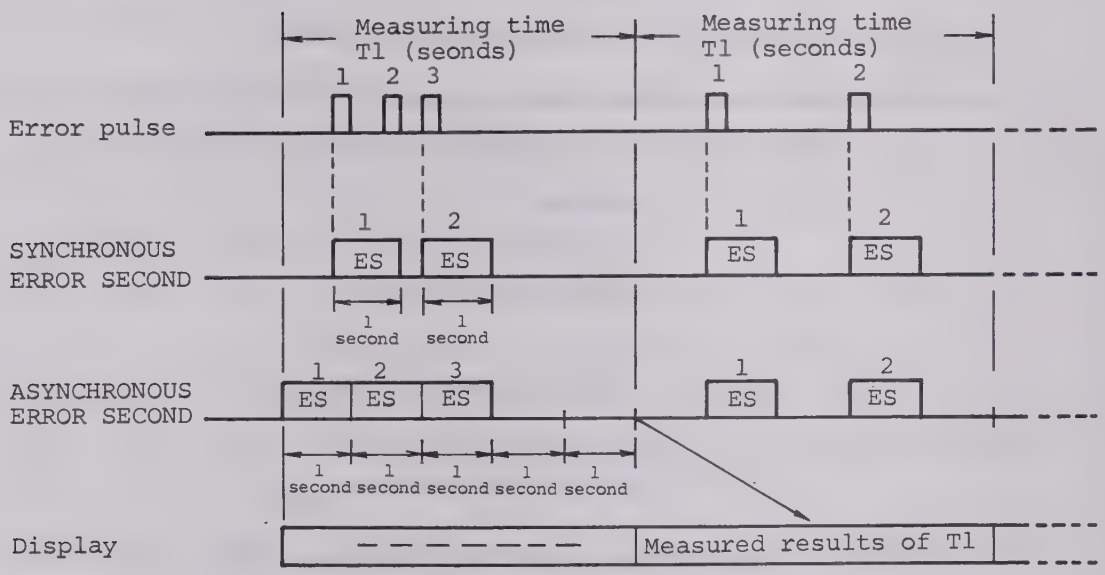


Fig. 5-20 Error Seconds

(d) % error free seconds

When the measuring time is set by BLOCK, % error free seconds cannot be measured.

Definition: Percentage of number of seconds without error pulse within the measuring time

$$\%\ \text{error free second} = \frac{\text{Measuring time (second)} - \text{error second}}{\text{Measuring time (second)}} \times 100\%$$

Measurement range: 0.0000% to 100%

(e) Threshold error seconds (TH ES)

When the measurement time is set by BLOCK, threshold error seconds cannot be measured.

Definition: Number of seconds which satisfy the threshold condition within the measuring time

Measuring range: 1 to 9.9×10^{9}
Threshold error rate: 10^{-3} to 10^{-7}

Threshold number of errors: 1, 5, 10, 100, and 1000

The threshold value can be set using FUNCTION SWITCH A3 to A6 on the rear panel. For details, refer to paragraph 3.2.4 (2).

Figure 5-21 shows the threshold error seconds when the threshold value is set by the error rate.

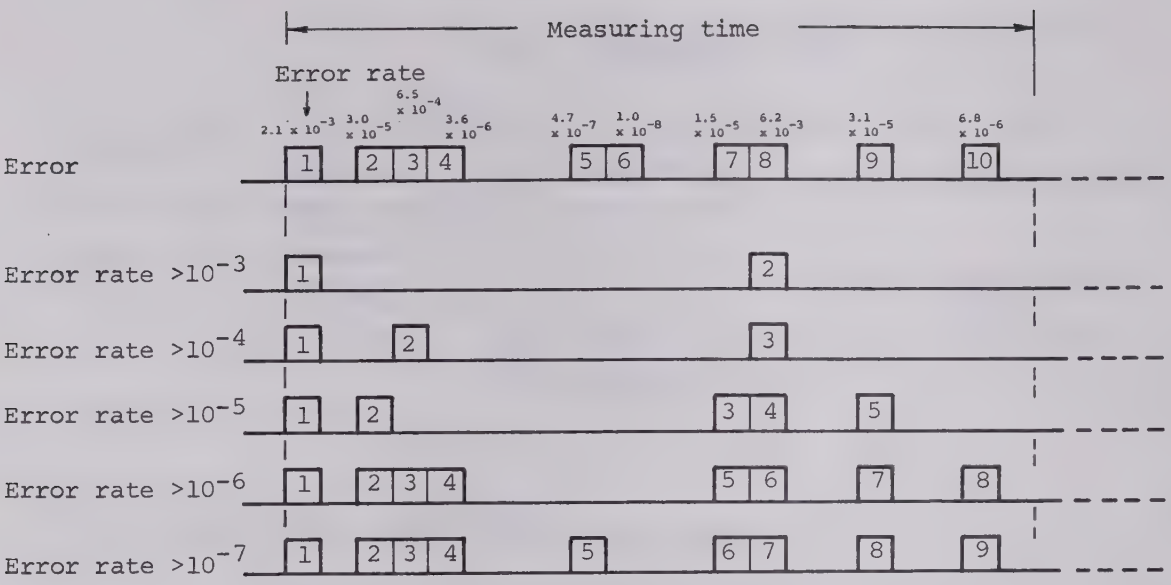


Fig. 5-21 Threshold Error Seconds (error rate)

(f) Error performance data

The error performance data are the measurement items recommended in CCITT G.821.

When the measurement time is set by BLOCK, the error performance data cannot be measured.

(i) Error free seconds (EFS)

$$EFS = \frac{\text{Sum of the seconds without errors}}{\text{S-avail*}} \times 100(\%)$$

(ii) Errored seconds (ES)

$$ES = \frac{\text{Sum of the seconds with at least one error}}{\text{S-avail*}} \times 100\%$$

(iii) Severely ES (SES)

$$SES = \frac{\text{Sum of the seconds with an error rate exceeding } 10^{-3}}{\text{S-avail*}} \times 100\%$$

(iv) Degraded minutes (DM)

$$DM = \frac{Md \times 60}{S\text{-}avail^*} \times 100\%$$

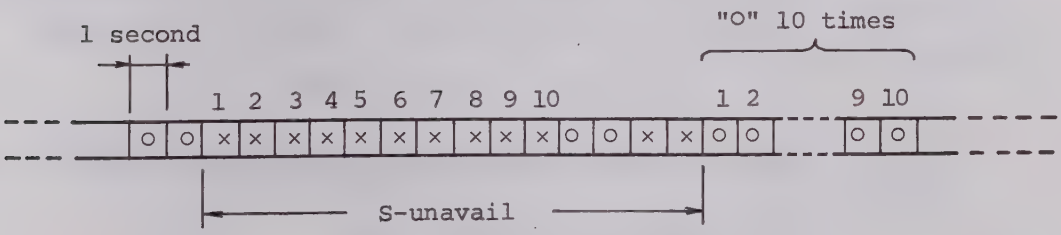
Md: First, the seconds where the error rate exceeds 10^{-3} in a second are removed from S-avail and the remaining seconds are consecutively grouped into blocks of 60. Md is the sum of blocks where the error rate in the block has exceeded 10^{-6}.

(v) Unavailable seconds (US)

$$US = \frac{S\text{-}unvail}{\text{Measuring time - power fail time}} \times 100\%$$

S-unvail:

Time from the time that the condition where the error rate in a second has exceeded 10^{-3} or the signal loss condition has existed continuously for at least 10 s, until a different condition has continued for at least 10 s.



X: The error rate in a second has exceeded 10^{-3} or the signal is lost.

O: Other than the above.

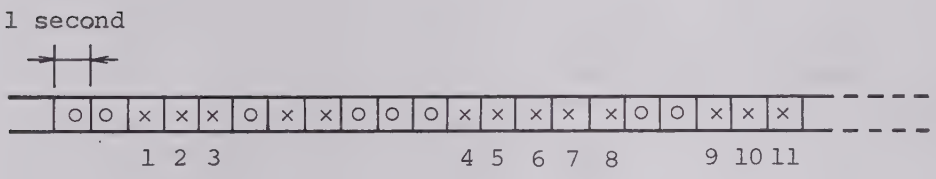
Fig. 5-22 S-unavail

*S-avail = Measuring time - power failure time - S-unavail - signal loss time other than S-unavail

(g) Consecutive severely errored seconds (CSES)

When the measurement time is set by BLOCK, CSES cannot be measured.

Definition: The sum total of error seconds when an error rate exceeding 10^{-3} lasts 3 seconds or more.



x: Error rate $>10^{-3}$
O: Error rate $\leqq 10^{-3}$

Fig. 5-23 CSES

This data is output with error performance data at the printer or via the GP-IB or RS-232C.

Therefore, if the error performance data output is off, this data is not output.

(4) Measurement condition and measurable error

(a) Error rate, error count, ES, %EFS, and TH ES

All the errors marked with x or Δ in the following table can be measured simultaneously.

Table 5-2 Measurement Condition and Measurable Error

Measurement condition					Error				
INPUT	FRAME	DEMUX	PATTERN	DS-1 FRAME	BIT	PARITY	FRAME	BIPOLAR	CRC-6
DS-3	FRAMED	OFF	Other than LIVE	-	x	x	x	x	-
			LIVE	-	-	x	x	x	-
		ON	Other than LIVE	D4	x*1	-	x	-	-
				ESF	x*1	-	x	-	x*1
			LIVE	D4	-	-	x	-	-
				ESF	-	-	x	-	x*1
	UNFRAMED	-	Other then LIVE	-	x	-	-	x	-
DS-2 DS-1C	FRAMED	-	Other than LIVE	-	x	-	x	x	-
			LIVE	-	-	-	x	x	-
	UNFRAMED	-	Other than LIVE	-	x	-	-	x	-
DS-1	FRAMED	-	Other than LIVE	D4	x	-	x	x	-
				ESF	x	-	x	x	x
			LIVE	D4	-	-	x	x	-
				DSF	-	-	x	x	x
	UNFRAMED	-	Other than LIVE	-	x	-	-	x	-
UNIPOLAR	-	-	-	-	Δ*2	Δ*2	Δ*2	-	Δ*2

*1 The error to be measured is a DS-1 signal error picked up out of the DS-3 signal.

*2 The errors to be measured are selected by setting the UNIPOLAR INPUT MODE with FUNCTION SWITCH A1 and A2 on the rear panel. For example, if MODE is DS-3, the errors shown in the DS-3 column of the above table are measured.

(b) Error performance data, CSES

Measurement is made for the following errors.

Pattern is not LIVE: BIT error

Pattern is LIVE: FRAME error

SECTION 6

SELF TEST

Direct connection between the transmitter with option 41 and the receiver with option 42, enables the ME3401A to perform self testing.

6.1 Connections and Settings

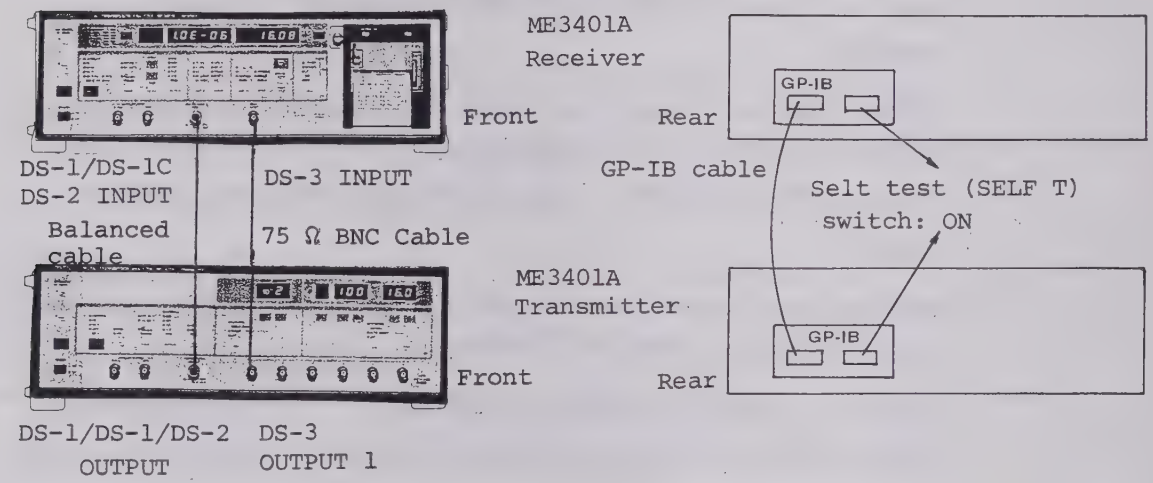


Fig. 6-1 Self Test Connections and Settings

6.2 Procedure

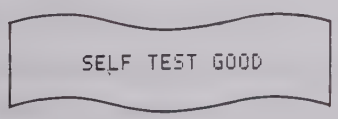
Step	Procedure
1	With both the transmitter and receiver POWER switches at the off position, turn on the rear panel SELF T switches of the transmitter and receiver.
2	Connect up the cables between the transmitter DS-3 OUTPUT 1 and the receiver DS-3 INPUT, and between the transmitter DS-1/DS-1C/DS-2 OUTPUT and the receiver DS-1/DS-1C/DS-2 INPUT.

(continued)

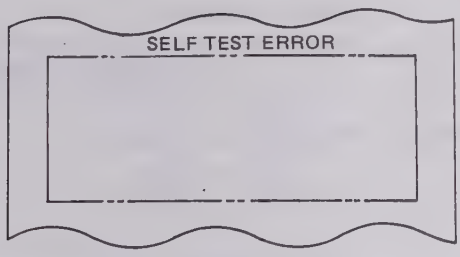
Step	Procedure
3	Connect the transmitter GP-IB interface and the receiver GP-IB interface with the attached GP-IB cable. At this time, remove all other measuring instruments and transmitter or receiver GP-IB cables.
4	First, turn on the receiver POWER switch, and then turn on the transmitter POWER switch within 1 second. After the LED test has been performed, enter the self-test mode. In the absence of an abnormality, the time needed for the self test will be about 1 minute. During self test, both the transmitter and receiver are in remote status ([CONTROL] LEDs light). When self test is completed, both the transmitter and receiver return to local status ([CONTROL] LEDs extinguish).
5	To stop self test press the transmitter and receiver [CONTROL] keys.

6.3 Output of Test Result

The test result is printed out by the printer (option 11) built into the receiver. When no abnormality is detected, printing is done as follows.



Printing is as indicated below when an abnormality occurs in the ME3401A.



The error contents are printed in the [ ].

The relationship between the abnormality and the print contents appearing in [ ] is shown below.

Print contents	Abnormality
GP-IB	GP-IB interface
(*1) SIGNAL LOSS	OUTPUT/INPUT SIGNAL (*1): DS-1, DS-1C, DS-2, or DS-3 is printed.
(*1) FRAME LOSS	FRAME
(*1) PATT SYNC LOSS	PATTERN
(*1) BLUE SIGNAL	PATTERN OR FRAME
DS-3 OUTPUT/INPUT	All DS-3 OUTPUT/INPUT levels
DS-3 DSX-3, HIGH I/O	2 DS-3 OUTPUT/INPUT levels
DS-3 DSX-3, LOW I/O	
DS-3 HIGH, LOW I/O	
DS-3 DSX-3 I/O	1 DS-3 OUTPUT/INPUT level
DS-3 HIGH I/O	
DS-3 LOW I/O	

(Continued)

Print contents	Abnormality
PATT PRBS (23)	PRBS 2^{23}-1 pattern
PATT ( )	WORD pattern ( ): Abnormal word pattern (111): 1111 (110): 1100 (10) : 1010 (100): 1000
ALARM DETECTION	Alarm detection
( )	( ): Undetected item (SIG) : SIGNAL LOSS (FRM) : FRAME LOSS (PAT) : PATTERN SYNC LOSS (BLUE): BLUE SIGNAL
DS-3 UNFRAMED	DS-3 UNFRAME
DS-3 ADD B	DS-3 error addition, or bit error measurement
ERROR AND SINGLE	DS-3 error addition (single), or all of ER RATE, ER COUNT, ES, %EFS, and TH ES
MEASUREMENT RATE COUNT ES %EFS TH	Error measurement item even when only one of the measurement items ER RATE, ER COUNT, ES, %EFS, TH ES is normal.
(*2) OUTPUT/INPUT	OUTPUT/INPUT LEVEL (*2): DS-1, DS-1C, or DS-2 is printed.
(*2) FRAMED	FRAME
(*2) UNFRAMED	UNFRAME
DS-1 B8SZ ESF	DS-1 B8SZ code, ESF frame

SECTION 7

GP-IB (OPT41, 42)

7.1 General

The ME3401A Digital Transmission Analyzer can be controlled via GP-IB (General Purpose Interface Bus) when the GP-IB interface option is mounted (OPT41 for transmitter, OPT42 for receiver).

Controllable items

- Panel settings
- Panel setting contents readout
- Measured data readout

The ME3401A GP-IB interface conforms to IEEE Standard 488-1978.

Option 41 and option 42 have different option numbers to distinguish them, but their characteristics are the same. Option 41 can be used in the receiver and option 42 can be used in the transmitter.

7.2 Specifications

Table 7-1 Specifications

Interface	Conforms to IEEE Standard 488-1978
Function	SH1: All source handshake functions AH1: All accept handshake functions T6 (transmitter) and T5 (receiver): Talker function, talk-only function (receiver only), serial polling function and talker release function by my listen address (MLA) L4: Listener function, no listen-only function, and listener release function by my talk address (MTA) SR1: All service request functions RL1: All remote/local functions PP0: No parallel polling function DC0 (transmitter) and DC1 (receiver): Device clear function (receiver only), when the receiver receives a device clear signal, it simply discards the old measured data DT0: No device trigger function C0 (transmitter) and C1 (receiver) Only the receiver support a control function. The receiver becomes a controller in the self-test mode.
Control contents	Panel setting Panel setting contents readout Measured data readout
Connector	24-pin
Ambient temperature, rated range of use	0° to 50°C

7.3 GP-IB Interface Unit Installation and Removal

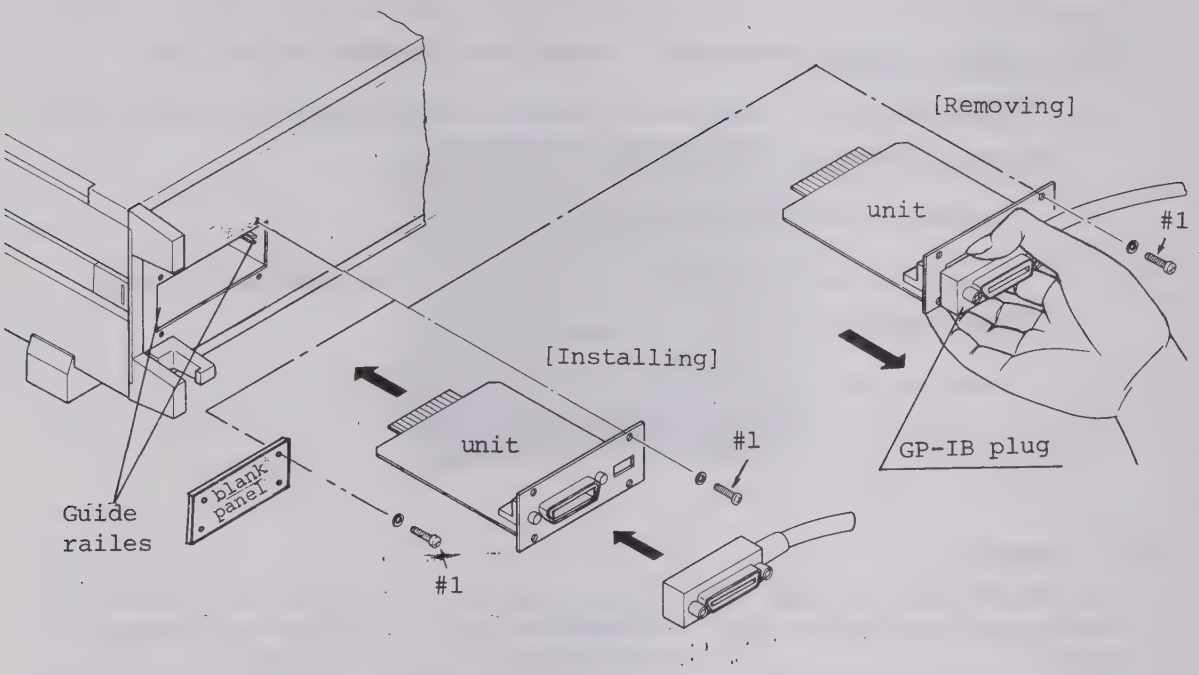


Fig. 7-1 GP-IB Interface Unit Installation and Removal

7.3.1 Installation

Step	Procedure
1	Turn the transmitter (receiver) POWER switch OFF.
2	Remove the 4 screws #1 on the blank panel on the rear panel of the transmitter (receiver).
3	Remove the blank panel.
4	Insert the GP-IB interface unit by aligning it with the guide rails.
5	Secure the unit with the 4 screws #1.

7.3.2 Removal

Step	Procedure
1	Turn the transmitter (receiver) POWER switch OFF.
2	Remove the 4 screws #1 on the GP-IB interface unit on the rear panel of the transmitter (receiver).
3	Attach a GP-IB plug to the GP-IB connector on the GP-IB interface unit, and remove the unit by pulling the GP-IB plug.
4	Secure the blank panel with the 4 screws #1 or install the RS-232C interface unit (See Section 8).

Figure 7-2 shows the GP-IB interface unit installed in the ME3401A.

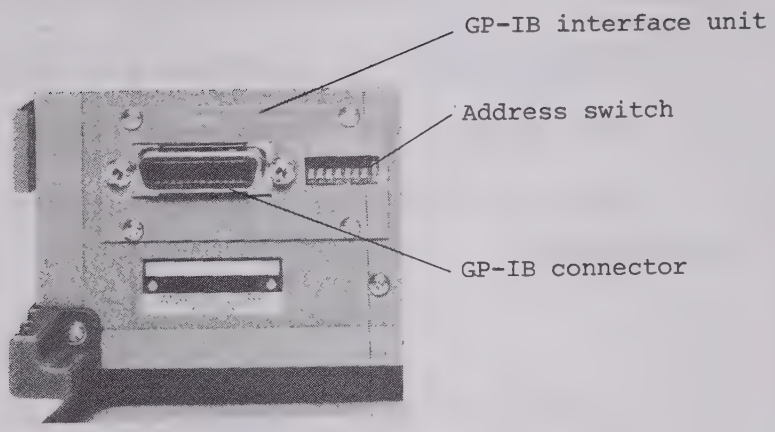


Fig. 7-2 GP-IB Interface Unit Installed in the ME3401A

7.4 Preparation

7.4.1 GP-IB cable connection

Up to 15 devices can be connected to a GP-IB system. However, note the following restrictions on cable length.

1. No cable must be more than 2 m long.
2. The total cable length must not be more than 20 m.

Figure 7-3 shows the GP-IB interface connector pin arrangement.

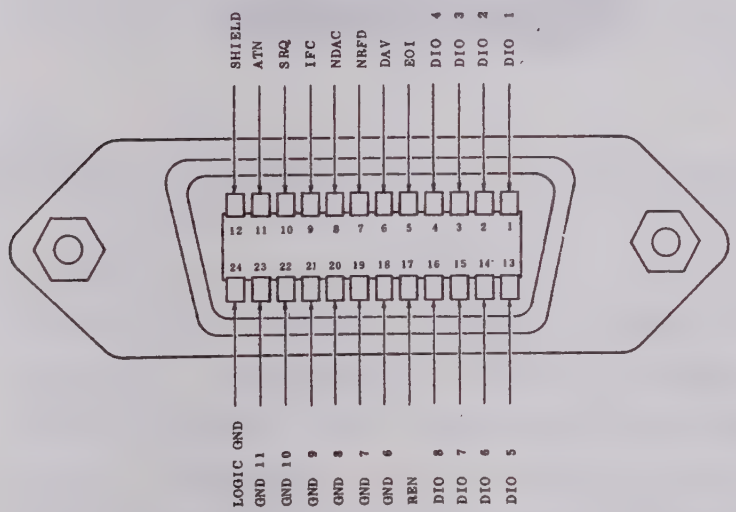


Fig. 7-3 GP-IB Interface Connector Pin Arrangement

Figure 7-4 shows an example of a measuring system using the GP-IB.

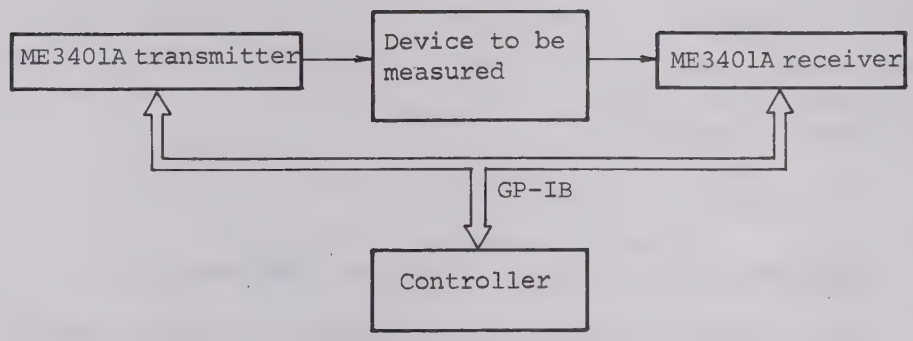


Fig. 7-4 Measuring System Using the GP-IB

7.4.2 Address setting

It is necessary to set the device address to control the device via the GP-IB interface.

In addition, if there are two or more devices on the GP-IB, each must have a different address. The ME3401A address switch location is shown in Fig. 7-2.

The ME3401A address is checked only at power-on. Therefore, the address must be changed at power-off and then the power must be turned on again.

Figure 7-5 shows an address setting example.

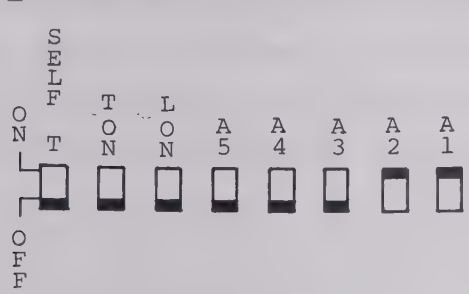


Fig. 7-5 Address Switches

Switches A1 to A5 shows in Fig. 7-5 have the following values.

A1: $2^0 = 1$

A2: $2^1 = 2$

A3: $2^2 = 4$

A4: $2^3 = 8$

A5: $2^4 = 16$

Therefore, in Fig. 7-5 the set address is 3.

The usable addresses for the ME3401A are 0 to 29. The TON switch at the left side of the address switch has the following function.

(1) TON (receiver only)

This is the talk-only mode.

In this mode, settings A1 to A5 are ignored.

This mode is used to output the measured data to the external printer.

The output data and timing are the same as when the address is set for outputting the data.

Always set the TON switch to OFF unless it is used for the above purpose.

Figure 7-6 shows TON usage example.

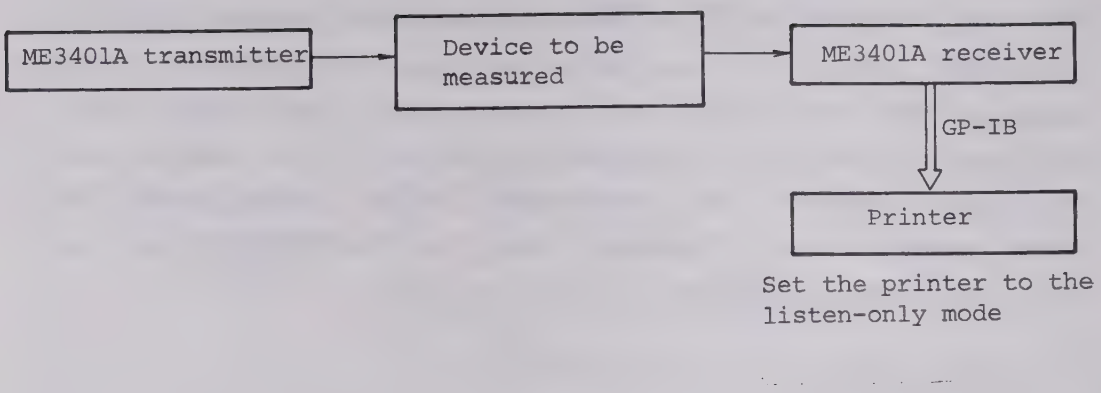


Fig. 7-6 TON Usage Example

(2) SELF T

This is the self-test mode.

In this mode, the transmitter and receiver are self-tested. For details, see Section 6.

(3) LON

The LON switches cannot be used. Always set this switch to OFF.

7.5 Operation

When the ME3401A is changed from the local mode (setting possible with panel keys) to the remote mode (setting performed from controller), all the panel setting contents are the same as in the local mode. In the remote mode, the rear panel level setting switches (EXTERNAL CLOCK, EXTERNAL DATA INPUT LEVEL, and UNIPOLAR OUTPUT LEVEL switches of the transmitter, and UNIPOLAR INPUT LEVEL switch of the receiver) cannot be remotely controlled.

When the ME3401A is changed from the remote mode to the local mode, the rear panel setting contents are the same as the rear panel switch settings. The front panel setting contents are the same as those in the remote mode. When the [CONTROL] key is pressed in the remote mode, the local mode is set. However, when LLO (local lock out) is received, the local mode cannot be set.

7.5.1 Panel setting

In the following explanation, the address of the transmitter and the receiver is set to 1 and 2, respectively. The panel setting is as follows:

```
WRITE @101:"   "
           ↑
           └──────── address
```

01 is the address. The example is for the transmitter.

Write in the control codes that correspond to the ME3401A panel key. These are enclosed in the quotation marks. When two or more codes are written, each code is separated by a comma (,).

- Setting example

  For the control code contents, refer to Tables 7-2 (transmitter section), and 7-3 (receiver).

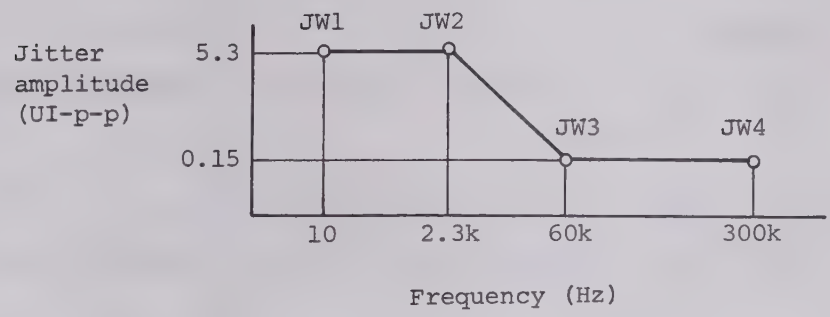
(1) Set the transmitter CLOCK to DS-1, CODE to AMI, and PATTERN to 1111 in the transmitter.

```
WRITE @101:"0C1,01A,0PA"
```

(2) Set the transmitter JITTER MOD to MANUAL, FREQUENCY to 1 kHz, AMPLITUDE to 3.30 UIp-p.

```
WRITE @101:"JMM,JF31,JA3.30"
```

(3) Set the transmitter JITTER AUTO SWEEP MASK as shown below.




```
WRITE @101:"JMA,JW1,JF11,JA5.30,JW2,JF3A,JA5.30
            JW3,JF46,JA0.15,JW4,JF53,JA0.15"
```

Notes:

1. When the current JITTER MOD is AUTO, "JMA" can be omitted.

2. Unchanged items can be omitted.

   Example:

   If JW3 uses the previously set value, delete "JW3", "JF46", and "JA0.15".

   Example:

   If the frequency of JW2 uses the previously set value, delete "JF3A".

(4) Set the receiver INTERVAL to 1 minute 30 seconds.

```
WRITE @102:"TDP,D00,H00,U01,C30"
```

Notes:

1. When the current DISPLAY is INTERVAL, "TDP" can be omitted.

   WRITE @102:"D00,H00,U01,S30"

2. For INTERVAL, the code for unchanged time can be omitted.

   For example, when DAY=00 and HOUR=00 are current settings, "D00" and "H00" can be omitted.

   WRITE @102:"TDP,U01,S30" or
   WRITE @102:"U01,S30"

(5) Set the receiver REAL TIME to 12 hours 34 minutes 56 seconds December 1st 1988.

```
WRITE @102:"TDR,Y88,N12,D01,H12,U34,C56"
```

Notes:

1. When the current DISPLAY is REAL TIME, "TDR" can be omitted.

   WRITE @102:"Y88,N12,D01,H12,U34,C56"

2. The code for unchanged data or time can be omitted.

Tables 7-2 and 7-3 show the transmitter and receiver control codes, respectively.

Table 7-2 Transmitter Control Code

Item			Code	Remarks
CLOCK	DS-3		OC3	
	DS-2		OC2	
	DS-1C		OCC	
	DS-1		OC1	
	EXTERNAL		OCE	
	EXTERNAL	DS-3	OE3	Valid only when CLOCK is EXTERNAL
		DS-2	OE2	
		DS-1C	OEC	
		DS-1	OE1	
CODE	DS-1	AMI	O1A	Valid only when CLOCK is DS-1 or EXTERNAL DS-1
		B8ZS	O1B	
	DS-3	B3ZS	O3B	Code when CLOCK is DS-3 or EXTERNAL DS-3 and PATTERN is 1000
		AMI	O3A	
FRAME	FRAMED		OFF	Ignored when PATTERN is EXTERNAL
	UNFRAMED		OFU	
	DS-1	D4	OF1	Valid only when CLOCK is DS-1 or EXTERNAL DS-1 and FRAME is FRAMED
		ESF	OF2	
PATTERN	PRBS		OPP	
	1111		OPA	
	1100		OPB	
	1010		OPC	
	1000		OPD	
	EXTERNAL		OPE	
	DS-3 PRBS	$2^{15}-1$	OP5	Pattern when CLOCK is DS-3 or EXTERNAL DS-3 and PATTERN is PRBS
		$2^{23}-1$	OP3	

Table 7-2 Transmitter Control Code (continued)

	Item		Code	Remarks
DS-3 LEVEL	DSX-3		OLX	Valid only when CLOCK is DS-3 or EXTERNAL DS-3
	HIGH		OLH	
	LOW		OLL	
DS-2 LEVEL	DSX-2		OLA	Valid only when CLOCK is DS-2 or EXTERNAL DS-2
	DS-2		OLB	
ERROR ADDITION	OFF		EAF	One error is added per code for SINGLE
	SINGLE		EAS	
	ERROR RATE	10^{-9}	EA9	
		10^{-8}	EA8	
		10^{-7}	EA7	
		10^{-6}	EA6	
		10^{-5}	EA5	
		10^{-4}	EA4	
		10^{-3}	EA3	
		10^{-2}	EA2	
	EXTERNAL		EAE	
	EXTERNAL	SINGLE	EES	Valid only when ERROR ADDITION is EXTERNAL
		BURST	EEB	
PANEL LOCK	OFF		LLF	If LLN is received, the [PANEL LOCK] key is set to ON in the local mode.
	ON		LLN	
AUTO SET	OFF		ASF	The AUTO SET contents cannot be changed. Change the AUTO SET contents in the local mode.
	ON		ASN	

Table 7-2 Transmitter Control Code (continued)

Item			Code	Remarks
JITTER MOD	OFF		JMF	Always OFF when jitter modulation function (OPT01) not mounted.
	AUTO		JMA	
	MANUAL		JMM	
	EXTERNAL		JME	
	FREQUENCY	2 Hz	JF02	. Valid only when MOD is MANUAL or when MOD is AUTO SWEEP and MASK SET . AMPLITUDE 1. Step 0.05 steps (0.00 to 5.00) 0.1 steps (5.1 to 16.2 for DS-3) (5.1 to 10.2 except for DS-3) 2. The displayed value is not a set value but a measured value. 3. Do not omit the first decimal place. 4. Setting example 0.1 UIp-p → JA0.1 1.25 UIp-p → JA1.25 6 UIp-p → JA6.0
		10 Hz	JF11	
		60 Hz	JF16	
		350 Hz	JF2A	
		500 Hz	JF25	
		900 Hz	JF29	
		1 kHz	JF31	
		2.3 kHz	JF3A	
		2.5 kHz	JF3B	
		3 kHz	JF33	
		4 kHz	JF34	
		8 kHz	JK38	
		10 kHz	JF41	
		15 kHz	JF4A	
		20 kHz	JF42	
		40 kHz	JF44	
		60 kHz	JF46	
		80 kHz	JF48	
		100 kHz	JF51	

Table 7-2 Transmitter Control Code (continued)

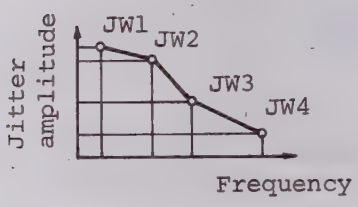
Item		Code	Remarks
JITTER MOD	FREQUENCY (continued)	160 kHz JF5A	
		200 kHz JF52	
		300 kHz JF53	
	AMPLITUDE (UIp-p)	0.00 JA[].[][]	
		⟆ ⟆	
		16.2 JA[][].[]	
	MASK SET		Valid only when MOD is AUTO SWEEP Format: JW[ ], frequency, jitter amplitude I The unchanged value can be omitted. Example: JW1,JF25,JA4.1, JW3,JA1.35 JW1 JW3

Table 7-3 Receiver Control Code

Item			Code	Remarks
INPUT	DSX-3		IIX	
	DS-3		II3	
	DS-2		II2	
	DS-1C		IIC	
	DS-1		II1	
	UNIPOLAR		IIU	
	UNIPOLAR	DS-3	IU3	Valid only when INPUT is UNIPOLAR
		DS-2	IU2	
		DS-1C	IUC	
		DS-1	IU1	
DS-1 CODE	AMI		I1A	Valid only when INPUT is DS-1
	B8ZS		I1B	
FRAME	FRAMED		IFF	
	UNFRAMED		IFU	
	DS-1	D4	IF1	Valid only when INPUT is DS-1 or UNIPOLAR DS-1 and FRAME is FRAMED
		ESF	IF2	
DEMUX TEST	OFF		IMF	ON only when INPUT is DS-3, DSX-3, or UNIPOLAR DS-3 and FRAME is FRAMED
	ON		IMN	
	CHANNEL	CH1	I01	Valid only when DEMUX TEST is ON
		⟆	⟆	
		CH28	I28	

Table 7-3 Receiver Control Code (continued)

Item			Code	Remarks
PATTERN	PRBS		IPP	When FRAME is UNFRAMED, LIVE cannot be set
	1111		IPA	
	1100		IPB	
	1010		IPC	
	1000		IPD	
	LIVE		IPL	
	DS-3 PRBS	2^{15}-1	IP5	Pattern when INPUT is DS-3, DSX-3, or UNIPOLAR DS-3 and PATTERN is PRBS
		2^{23}-1	IP3	
MEASUREMENT DISPLAY	ER RATE		MDR	
	ER COUNT		MDC	
	ES		MDE	
	% EFS		MDF	
	TH ES		MDT	
	TH ES	ER RATE	MTR	
		ER COUNT	MTC	
		$>10^{-7}$,1	MT7	
		$>10^{-6}$,5	MT6	
		$>10^{-5}$,10	MT5	
		$>10^{-4}$,100	MT4	
		$>10^{-3}$,1000	MT3	
HISTORY RESET			MHR	

Table 7-3 Receiver Control Code (continued)

	Item	Code	Remarks
ERROR	BIT	MEB	
	PARITY	MEP	
	FRAME	MEF	
	BIP V	MEV	
	CRC-6	MEC	
BUZZER	OFF	MBF	
	ON	MBN	
TIME DISPLAY	TIMED	TDT	
	ELAPSED	TDE	
	INTERVAL	TDP	
	REAL TIME	TDR	
MODE	REPEAT	TMR	
	SINGLE	TMS	
	UNTIMED	TMU	
START		MGS	
STOP		MGP	
PAUSE		MGU	
CONT		MGC	
HMS		TDH	UIp-p cannot be set when jitter measurement function (OPT02) not mounted
YMD		TDY	
UIp-p		TDJ	

Table 7-3 Receiver Control Code (continued)

Item			Code	Remarks
TIME SET	TIME	YEAR	Y[][]	. YEAR and MONTH is valid only for REAL TIME . Always set a two-digit value to [][] . Example Year 1988: Y88 2nd day: D02
		MONTH	N[][]	
		DAY	D[][]	
		HOUR	H[][]	
		MINUTE	U[][]	
		SECOND	C[][]	
	BLOCK	10^6	BL6	
		10^7	BL7	
		10^8	BL8	
		10^9	BL9	
	MEAS PERIOD	TIME	TPT	
		BLOCK	TPB	
PANEL LOCK	OFF		LLF	When LLN is received, the [PANEL LOCK] key is turned ON in the local mode.
	ON		LLN	
AUTO SET	OFF		ASF	The contents of AUTO SET cannot be changed. Change the contents of AUTO SET in the local mode.
	ON		ASN	
JITTER MEANS	OFF		JMF	Always OFF when jitter measurement function (OPT02) not mounted.
	ON FILTER	OFF	JFF	
		LP	JFL	
		LP+HP1	JF1	
		LP+HP2	JF2	
ES	ASYNC		MSA	
	SYNC		MSS	
ERROR INHIBI-TION	NOT		MIF	Present only when ES is ASYNC
	Present		MIN	

Table 7-3 Receiver Control Code (continued)

Item			Code	Remarks
ERROR OUTPUT	BIT		EOB	
	PARITY		EOP	
	FRAME		EOF	
	BIP V		EOV	
PRINTER	PRINT	OFF	PPF	. Items marked with the symbol * have codes common with the receiver data fetch code.
		ON	PPN	
	MANUAL PRINT*		GMD	. PAPER FEED is one line per code.
	PAPER FEED		PFE	. PAPER FEED is valid only when PRINT is ON.
	MEASURED DATA CONTENT *	ERROR RATE	PCE	
		ALL DATA	PCA	
	THRESHOLDES*	NOT PRINT	PTF	
		PRINT	PTN	
	ERROR PERFORMANCE *	NOT PRINT	PEF	
		PRINT	PEN	
	INTERMEDIATE DATA	NOT PRINT	PIF	
		PRINT	PIN	
	CURRENT DATA PRINTING	NOT PRINT	PRF	
		PRINT	PRN	
	CONTENT *	ERROR RATE	PCR	
		ERROR COUNT	PCC	
	THRESHOLD *	>0	PT0	
		$>10^{-3}$,100	PT3	
	PAPER SAVING	OFF	PSF	
		ON	PSN	
	FORMAT		PFN	
		ABCD	PFI	

7.5.2 Panel setting readout

Table 7-4 Transmitter/Receiver Readout Code

Item	Code	Remarks
Panel setting contents request	GSW	The panel setting contents are output on request

. Program example

```
10 DIM A$*255
20 WRITE @101:"GSW"
30 READ @101:A$
40 PRINT A$
50 END
```

Note:

Read out the panel settings when other data such as measured data, etc. is not being output.
If panel setting readout is executed when other data remains, the "GSW" code is ignored.

. Output example

(1) Transmitter

```
0C3,0FF,0PP,0LX,EA6,JMM,JF11,0E3,01A,EE5,0F1,ASF,0P5,03B,0LA
```

(2) Receiver

```
IIX,IFF,IPP,INN,I28,TMR,ASF,JFF,MBF,IU3,I1B,MT7,MSA,MTR,IF1,IP5,
MIF,PPF
```

7.6 Fetching Measured Data

7.6.1 Transmitter

Table 7-5 Transmitter Data Fetch Code

Item	Code	Remarks
Jitter amplitude data request	GJA	. The jitter data is output only on request. . The jitter data is output only when JITTER MOD is MANUAL or EXTERNAL. . The data immediately before the code reception is output.

. Program example

```
10 DIM A$*255
20 WRITE @101:"GJA"
30 READ @101:A$
40 PRINT A$
50 END
```

. Output example

```
J3.71UI-PP
```

7.6.2 Receiver

Table 7-6 Receiver Data Fetch Code

Item			Code	Remarks
Measurement start time data request			GST	This data is output only on request.
Measurement-in-progress data request			GMD	
Jitter data request			GJD	
Measured data	Contents *	Standard	PCA	Items marked with the symbol * have codes common with the receiver printer control code.
		Error rate only	PCE	
	THRESHOLD ES data printing *	No	PTF	Setting of the items with the symbol ** are held at power off.
		Yes	PTN	
	ERROR PERFORMANCE data printing *	No	PEF	
		Yes	PEN	
Current data	Output **	Off	GCF	
		On	GCN	
	Content *	Error rate	PCR	
		Error count	PCC	
	Threshold level *	>0	PT0	
		$>10^{-3}$,100	PT3	
Alarm data output **		Off	GAF	
		On	GAN	

The data output timing and contents are almost the same as in printing.

The data output timing and contents are shown below.

The data output timing and contents are shown below.

Data output requires nearly 1 second/line. If each data output occupies many lines, set a longer measuring time. Also, if the measured data is collected in the 1 to 3-second cycle, set the measurement item to the error rate only. CR and LF are attached after the data. If the data has many lines, CR and LF are attached to each line.

To delete old data remaining in the receiver, use DCL @102. Set an approx. 0.5-second wait time after this command.

Data can be kept for approx 3 seconds line.

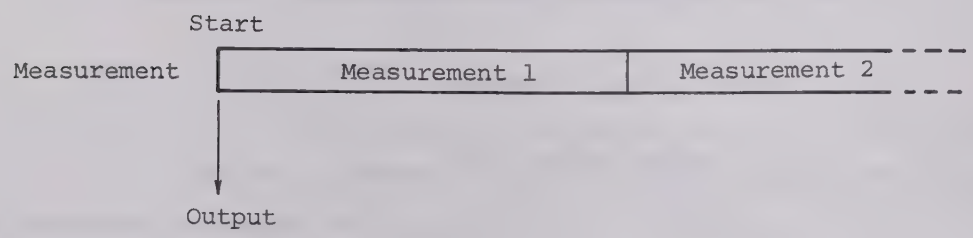
If no data request is issued from the controller within 3 seconds after the data generation, the data is discarded.

See paragraph 7.6.2 (1) and (2) for data generation timing.

(1) Automatically output data

(a) Measurement start data

This data is output at measurement start.

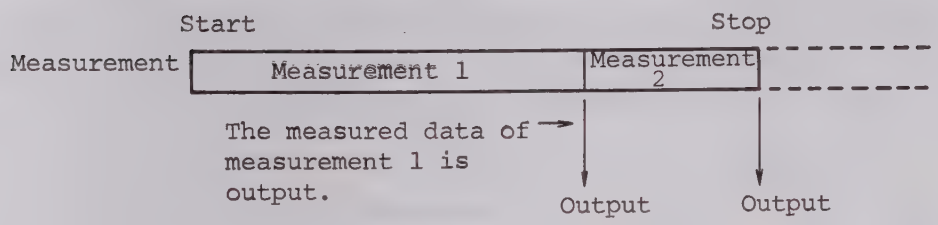


. Data output example

```
START JAN02/02:42:52
```

(b) Measured data

This is the measured result output at measurement completion.



The measured data consists of the following four blocks.

Standard data (4 lines) or error rate (1 line) only	
Jitter amplitude data (1 line) *	This is output only when the JITTER [MEAS] key is ON.
THRESHOLD ES data (2 lines)	The output can be turned on/off.
ERROR PERFORMANCE data (2 line)	

* This jitter amplitude data is the maximum value during the measurement period.

. Data output example

(i) Error rate only

```
* END JAN01/21:36:37 B=1.6E-03 V=0.0E-09 P=2.4E-05 F=1.6E-03
```

(ii) Standard data + jitter amplitude data

```
① START JAN01/21:38:26END   JAN01/21:38:36ELAPSED  00/00:00:10* MEAS DATA (DS-3) *
②        BIT    BIP V  ER 9.2E-07 0.0E-09  EC    408       0   ES      4       0
  %EFS 60.0000    100
③      PARITY   FRAME  ER 9.1E-07 1.1E-06  EC    408       3   ES      4       2
  %EFS 60.0000 80.0000
④ *  ALARM SECONDS   * POW F   0s SIG L   0s FRM L   0s BLUE    0s PAT L   0s XBIT    0s
⑤ * JITTER 11.39UI-PP*
```

① to ⑤ indicate the line number.

(iii) Standard data + jitter amplitude data + THRESHOLD ES data + ERROR PERFORMANCE data

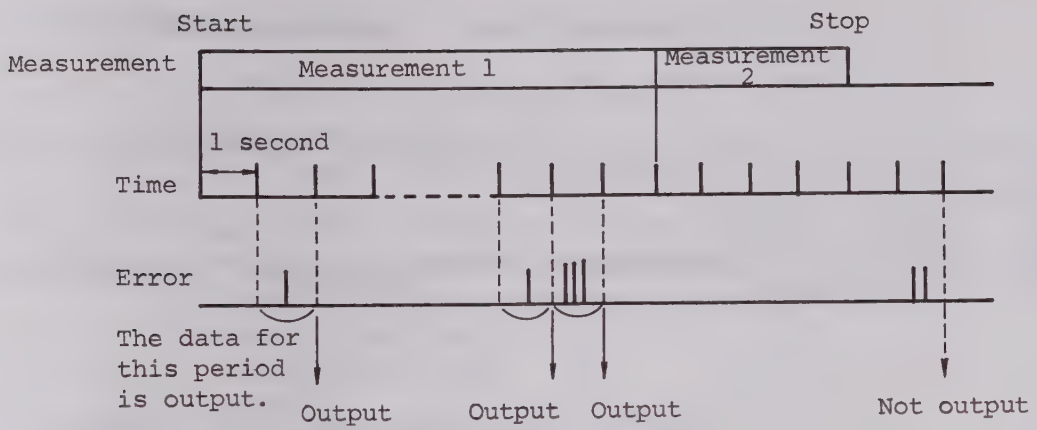
```
①  START JAN01/19:55:40END   JAN01/20:10:40ELAPSED  00/00:15:00* MEAS DATA (DS-3) *
②        BIT    BIP V  ER 3.3E-04 0.0E-11  EC 1.3E07       0   ES     46       0
  %EFS 94.8889    100
③      PARITY   FRAME  ER 4.0E-06 1.3E-03  EC 1.6E05  3.0E05   ES     47      38
  %EFS 94.7778 95.7778
④ *  ALARM SECONDS   * POW F   0s SIG L   0s FRM L   3s BLUE    0s PAT L   0s XBIT   36s
⑤ * JITTER  1.33UI-PP*
⑥ *   THRESHOLD ES   *          BIT  BIP V >E-3      34       0 >E-4      35       0
   >E-5      36       0 >E-6      36       0 >E-7      39       0
⑦       PARITY  FRAME >E-3       0      37 >E-4      26      38 >E-5      38      38
   >E-6      38      38 >E-7      40      38
⑧ * ERROR PERFORMANCE* ES (BIT)    3.9370% EFS        96.0630% SES(>E-3)   2.5872%
⑨  DM (>E-6)   6.7492% US          1.2222%
   CSES             5
```

① to ⑨ indicate the line number.

(c) Current data

This data is the error rate or error count during 1 second. It is output when the error occurs.

However, this data is not output at measurement cessation, SIGNAL LOSS, FRAME LOSS, and PATTERN SY LOSS.



The following settings can be performed concerning this data.

(i) Output ON/OFF

(ii) Selecting output error between error rate and error count

(iii) Selecting printing condition between printing when there is an error and printing only when the threshold level ($>10^{-3}$ for error rate mode or >100 for error count mode) is exceeded.

. Data output example

(i) Error rate

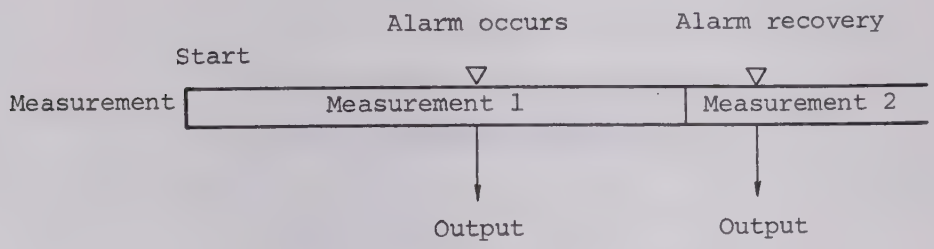
```
01/01:02:32 B=4.1E-4 B.V=0.0E-8 P=6.5E-5   F=8.1E-4
```

(ii) Number of errors

```
01/01:03:58 B=15664   B.V=    0 P= 2558     F=  186
```

(d) Alarm data

This is data output when an alarm occurs and when it is restored.



This data output can be turned on/off.

. Data output example

(i) SIGNAL LOSS

```
SIG LOSS 01/01:07:59
SIG GAIN 01/01:08:02
```

(ii) FRAME LOSS

```
FRM LOSS 01/01:08:10
FRM GAIN 01/01:08:12
```

```
FRM F2 L 11/19:35:52
FRM F2 G 11/19:35:55
```

L: LOSS, G: GAIN DS-2 frame loss when the [DEMUX] key is ON.

```
FRM F1 L 11/19:34:24
FRM F1 G 11/19:34:27
```

L: LOSS, G: GAIN DS-1 frame loss when the [DEMUX] key is ON.

(iii) PATTERN SY LOSS

```
PAT SY L 01/01:08:24
PAT SY G 01/01:08:26
```

L: LOSS, G: GAIN

(iv) BLUE SIGNAL

```
BLUE DET 01/01:10:00
BLUE NOT 01/01:10:03
```

(e) Program example

The receiver address is 02.

The printer address is 03.

(i) Fetching and printing measured data, current data, and alarm data

. Program example

```
10  DIM A$*255
20  WRITE @102:"PCE,BCN,BAN"
30  WRITE @102:"MSS"
40  READ @102:A$
50  WRITE @103:A$
60  GO TO 40
70  END
```

. Output example

```
START JAN01/21:02:40
*         01/21:02:45 B=2.3E-8 B.V=0.0E-8 P=2.2E-8    F=0.0E-6
FRM LOSS 01/21:02:51
FRM GAIN 01/21:02:54
* END JAN01/21:03:40 B=1.8E-02 V=0.0E-10 P=5.2E-06 F=1.8E-02
```

(ii) Fetching data every 2 seconds and printing time and bit error rate when bit error occurs.

. Program example

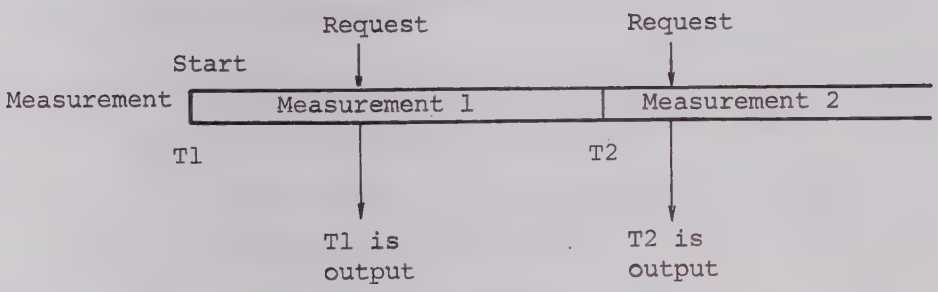
```
100  DIM A$*255
110  WRITE @102:"MGP,PCE,GCF,GAF"
120  WRITE @102:"TDP,CO2,TMR"
130  DCL @102
140  WAIT DELAY .5
150  WRITE @102:"MGS"
160  READ @102:A$
170  IF A$(24:24)="0" THEN GO TO 160
180  WRITE @103:A$(7:20)&"    "&A$(24:30)
190  GO TO 160
200  END
```

. Output example

```
JAN01/21:40:16
JAN01/21:40:24    1.1E-08
JAN01/21:40:30    1.3E-03
```

(2) Data output only on request

(a) Measurement start time



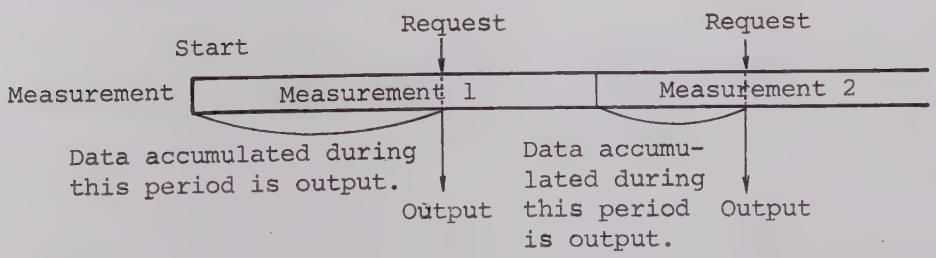
. Program example

```
10  DIM A$*255
20  WRITE @102:"GST"
30  READ @102:A$
40  PRINT A$
50  END
```

. Data output example

```
START JAN01/20:49:13
```

(b) Intermediate data



. Program example

The following program fetches the intermediate data.

```
10  DIM A$*255
20  LET N=1
30  WRITE @102:"PCE,GMD"
40  FOR I=1 TO N
50    READ @102:A$
60  NEXT I
70  END
```

The value of N of line 20 is obtained from the following table.

Standard data only	N=4
Error rate data only	N=1
THRESHOLD ES data addition	Add 2 to N
ERROR PERFORMANCE data addition	Add 1 to N
Jitter amplitude data addition	Add 1 to N

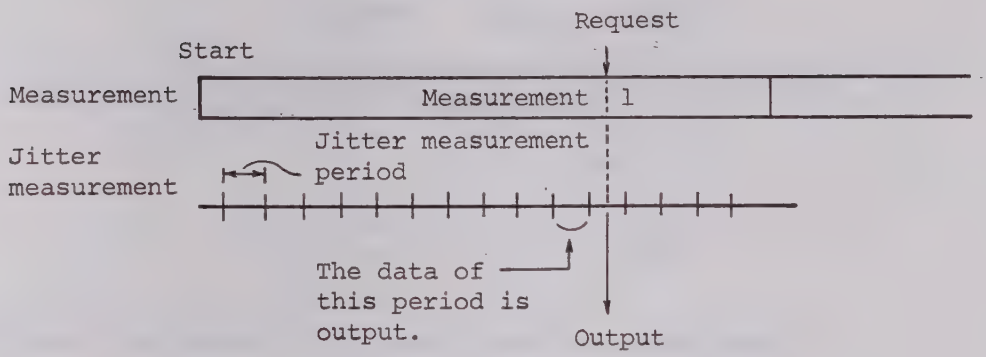
In the above table, when, for example, output data = standard data + THRESHOLD data + ERROR PERFORMANCE data + jitter amplitude data, N = 9 is obtained.

. Data output example (Error rate data only)

```
* INT JAN01/20:55:24 B=0.0E-10 V=0.0E-10 P=0.0E-10 F=0.0E-07
```

(c) Jitter amplitude data

The jitter amplitude data is output only when the JITTER [MEAS] key is ON.



. Program example

```
10  DIM A$*255
20  WRITE @102:"GJD"
30  READ @102:A$
40  PRINT A$
50  END
```

. Data output example

```
* JITTER  3.24UI-PP*
```

(3) Status data

The status data is 1-byte data which is used by a device with the SR function to notify the status of measured data in response to polling (serial polling) from the controller.

By using this data, the existence of data and the data contents in the measuring instrument can be confirmed before fetching data. The ME3401A receiver has this function.

The allocation of the status data is shown below.

DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
0	RQS	0	0	0/1	MEASURED DATA	CURRENT DATA	ALARM DATA

RQS: Request Service

This bit indicates whether or not the ME3401A receiver has issued a service request.

When any of the following data is issued, the RQS bit becomes "1".

. Measured Data

. Current Data

. Alarm Data

In the other than the above cases, the RQS bit is "0".

When the STATUS instruction is executed after issuing the above data, the RQS bit becomes "0".

DIO4: This bit becomes "1" if there is any data remaining in the measuring instrument.

DIO3 to DIO1: These bits indicate the data contents.

DIO3: Becomes "1" when there is measured data or measurement start data and becomes "0" for other cases

DIO2: Becomes "1" when there is current data and becomes "0" for other cases

DIO1: Becomes "1" when there is alarm data and becomes "0" for other cases

. Program example

A program example in which the status data contents are checked every second by the controller, and, if there are any data, read, is shown below.

```
100  DIM A$*255
110  WRITE @102:"PCE,MGS"
120  STATUS @102:S
130  LET B$=BSTR$(S,8)
140  LET C=VAL(B$(2:2))
150  IF C=0 THEN GO TO 180
160  READ @102:A$
170  PRINT A$
180  WAIT DELAY 1
190  GO TO 120
200  END
```

Line 120 to 150: Assesses RQS bit "1" or "0"

. Output example

```
*        02/02:04:07 B=2.3E-8 B.V=0.0E-8 P=2.2E-8   F=0.0E-6
FRM LOSS 02/02:04:16
FRM GAIN 02/02:04:20
*        02/02:04:37 B=2.3E-8 B.V=0.0E-8 P=2.2E-8   F=0.0E-6
* END JAN02/02:04:42 B=3.1E-02 V=0.0E-10 P=9.3E-06 F=3.3E-02
```

SECTION 8

RS-232C (OPT43, 44)

8.1 General

The ME3401A RS-232C conforms to the Electric Industries Association (EIA) standards.

Except for the POWER switch and PANEL LOCK key, all panel keys of the ME3401A can be controlled through the RS-232C interface.

The ME3401A can also output the set panel contents or measurement data through the RS-232C interface.

The ME3401A can use the RS-232C interface with the following optional numbers, which are all the same.

OPT 43: For ME3401A Transmitter

OPT 44: For ME3401A Receiver

8.2 Functions

Table 8-1 Functions

Item	Remarks	Setting at shipment
Interface	Conforms to the EIA standards.	———
Communication formula	Full Duplex Nonsynchronous	———
Baud rate	50, 75, 110, 134.5, 150, 300 600, 1200, bps (Selectable by the Baud Rate switch on the rear panel.)	300 bps
Character length	7 bits, 8 bits (Selectable by the internal siwtch.)	7 bits
Parity	Odd, even, none (Selectable by the internal switch.)	Odd
Number of start bits	1 bit	———
Number of stop bits	1 bit, $1\frac{1}{2}$ bit, 2 bit (Selectable by the internal switch.)	1 bit
Settable items by RS-232C	All items on the front panel excluding the POWER switch and PANEL LOCK key.	———
Connector	DB-25P	———
Ambient temperature, rated range of use	0° to 50°C	———

8.3 RS-232C Interface Unit Installation and Removal

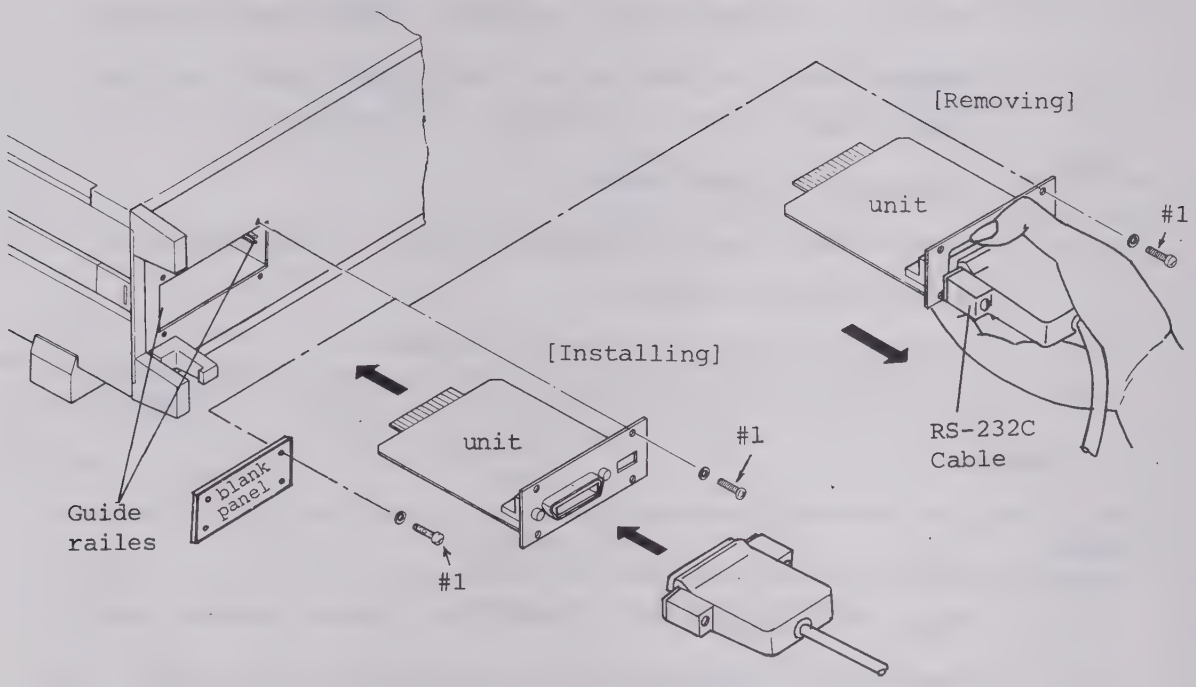


Fig. 8-1 RS-232C Interface Unit Installation and Removal

8.3.1 Installation

Step	Procedure
1	Turn the transmitter (receiver) POWER switch OFF.
2	Remove the 4 screws #1 on the blank panel on the rear panel of the transmitter (receiver).
3	Remove the blank panel.
4	Insert the RS-232C interface unit by aligning it with the guide rails.
5	Secure the unit with the 4 screws #1.

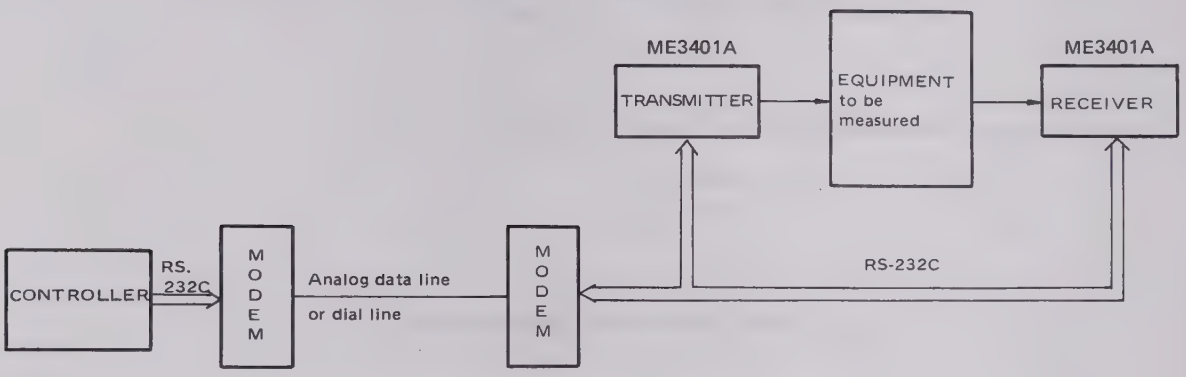
8.3.2 Removal

Step	Procedure
1	Turn the transmitter (receiver) POWER switch OFF.
2	Remove the 4 screws #1 on the RS-232C interface unit on the rear panel of the transmitter (receiver).
3	Attach a RS-232C plug to the RS-232C connector on the RS-232C interface unit, and remove the unit by pulling the RS-232C plug.
4	Secure the blank panel with the 4 screws #1 or install the GP-IB interface unit (see Section 7).

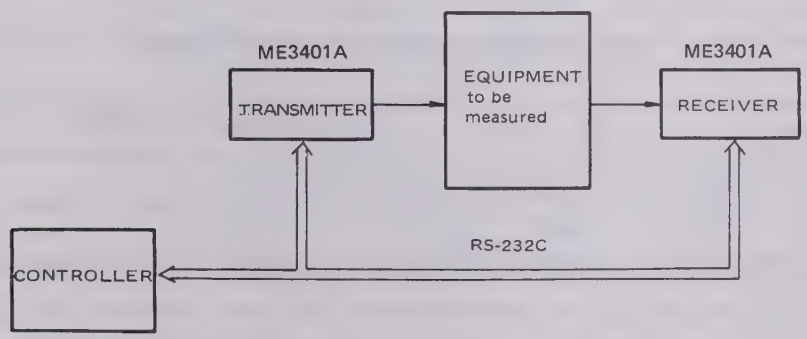
8.4 Preparations

8.4.1 Setup

Figure 8-2 is an example of the RS-232C interface steup.



(1) Setup of using a modem



(2) Setup of direct control from a controller

Fig. 8-2 RS-232C Interface Setup

8.4.2 RS-232C interface rear panel setting

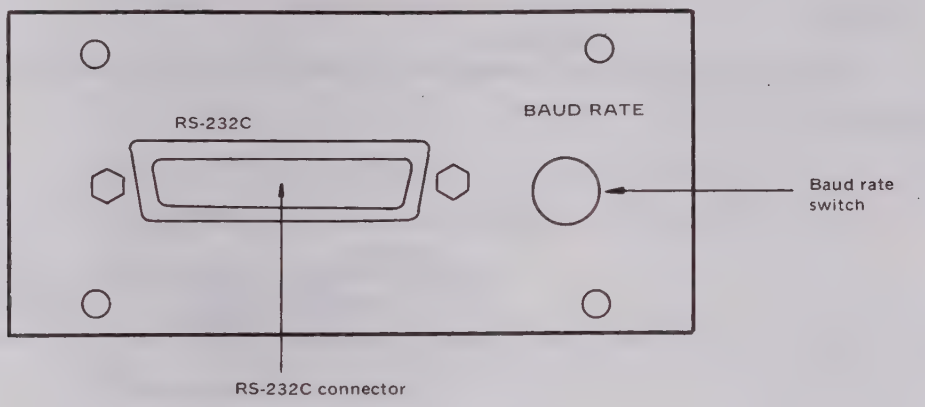


Fig. 8-3 RS-232C Rear Panel

Table 8-2 shows the correspondence between the numbers marked on the baud rate switch and baud rates.

Table 8-2 Correspondence Between the Number and Baud Rates

Number	0	1	2	3	4	5	6	7	8	9
Baud rate (bps)	50	75	110	134.5	150	300	600	1200	—	—

Note: Do not use numbers 8 and 9.

The BAUD RATE switch can be set to the required baud rate by turning the arrow mark in the switch to the number corresponding to it. In the example below, the arrow mark is set to 0.

The ME3401A verifies the baud rate only when the power switch is turned ON. Therefore, for every time of changing the baud rate, the power switch of the ME3401A must be turned OFF once, and then turned ON to be verified.

8.4.3 RS-232C interface internal switch setting

Figure 8-4 shows the location of the internal switch S2 and Fig. 8-5 shows the functions of the S2 switch bits.

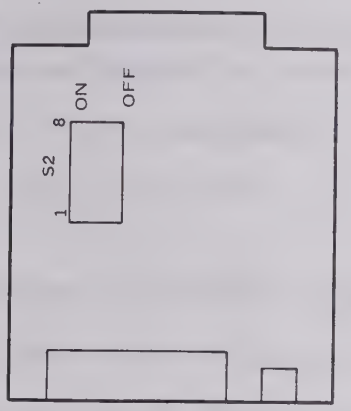
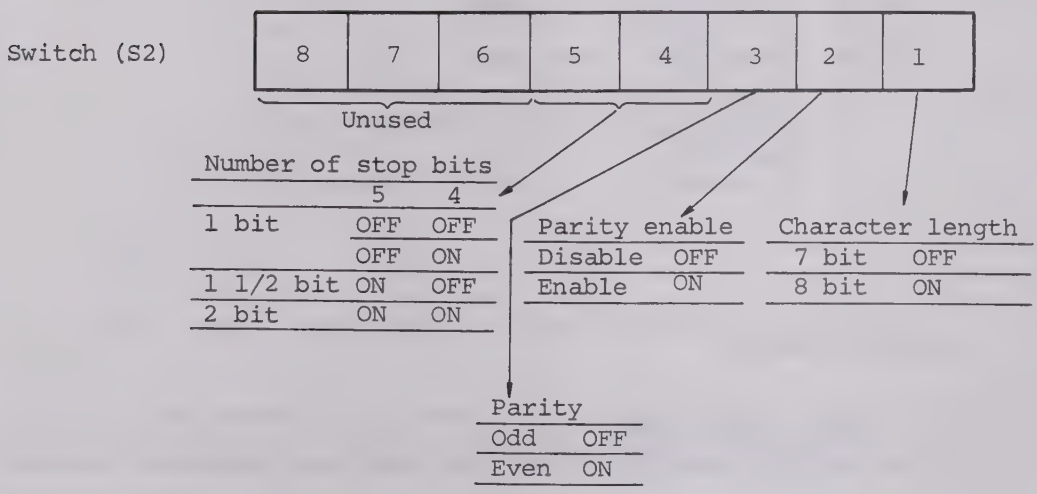


Fig. 8-4 Location of the Internal Switch



All the bits are OFF at shipment.

Fig. 8-5 Internal Switch S2

8.4.4 Fetching measured data

The ME3401A setting method and data fetching method are the same as the GP-IB method except for the address setting method.

For details, refer to paragraph 7.6. In paragraph 7.6, the address setting should be changed as shown below.

GP-IB		RS-232C
@101	→	@5
@102		

However, change DCL@101 to WRITE@5:"DCL"

No status byte can be used with the RS-232C interface.

. Program example

A program example in which measured data is fetched every 3 seconds is shown below.

```
100  DIM A$*255
110  WRITE @5:"MGP,PCE,GCF,GAF"
120  WAIT DELAY .5
130  WRITE @5:"TDP,CO3,TMR"
140  WAIT DELAY .5
150  WRITE @5:"MGS"
160  READ @5:A$
170  PRINT A$
180  GO TO 160
190  END
```

. Output example

```
START JAN01/22:57:01
* END JAN01/22:57:04 B=2.1E-04 V=0.0E-09 P=2.2E-06 F=2.1E-04
* END JAN01/22:57:07 B=3.8E-03 V=0.0E-09 P=4.0E-05 F=3.8E-03
```

8.4.5 Controller setting

To operate the controller with the RS-232C interface, the baud rate and the parity set in the RS-232C interfade must also be set in the controller.

In the following explanation, the ANRITSU Packet III is used as the controller.

The controller is set as follows.

```
SET @5: HVAL ("Set point")
     ↑                  ↑
   Select               |
   code                 See Figs. 8-6 and 8-7.
```

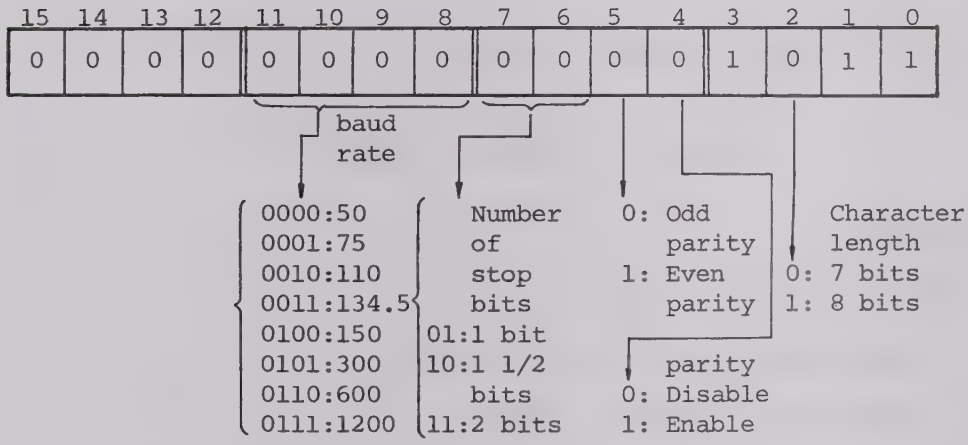
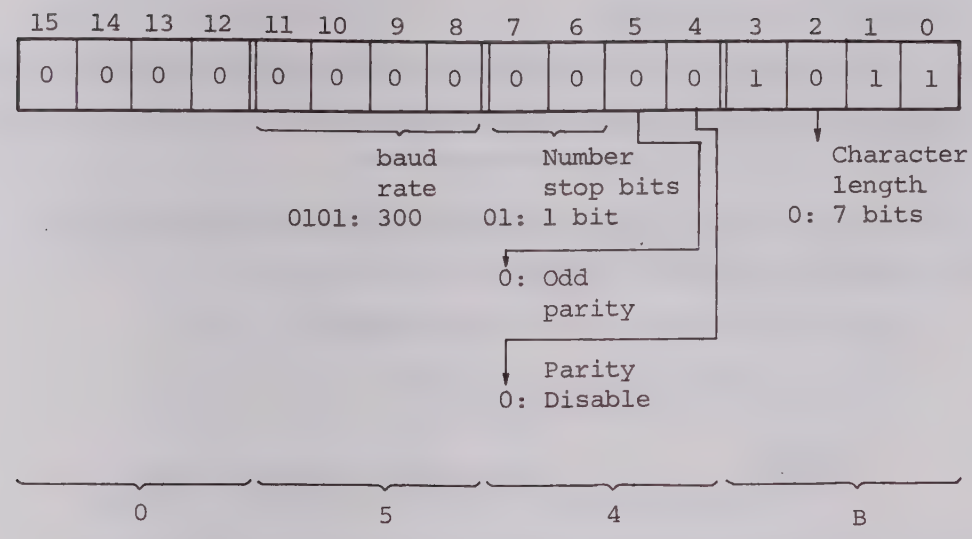


Fig. 8-6 Set Point of the RS-232C Interface

As an example, a setting is shown when each of the switch setting for the RS-232C interface of the ME3401A initiated.



SET @5: HVAL ("054B")

Fig. 8-7 Initial Set Point

8.5 Operation

8.5.1 ME3401A panel setting

The panel is set as follows.

WRITE @5: "Control code"

See Tables 7-2 and 7-3 for the control codes.

8.5.2 ME3401A panel setting read-out

A program example for the transmitter is given below.

```
10   DIM AS*255
20   WRITE @5: "GSW"
30   READ @5: A$
40   PRINT A$
50   END
```

The output data is the same as that for the GP-IB. See paragraph 7.5.2.

SECTION 9

PERFORMANCE CHECK

9.1 General

The performance is checked to determine whether the main functions of the ME3401A meet the specifications. This section lists the equipment required for the performance check and explains how each test is conducted.

If the performance check results meet every specification, the ME3401A is ready for normal use. The following performance checks should be performed at least once every year.

9.1.1 Transmitter performance check items

Table 9-1 Transmitter Performance Check Items

Paragraph	Item
9.4.1	Internal clock
9.4.2	External clock
9.4.3	Pattern
9.4.4	Frame
9.4.5	Error addition
9.4.6	DS-3 output
9.4.7	DS-1/DS-1C/DS-2 OUTPUT
9.4.8	Unipolar output
9.4.9	X-bit input
9.4.10	External data
9.4.11	Jitter modulation (OPT 01)

9.1.2 Receiver performance check items

Table 9-2 Receiver Performance Check Items

Paragraph	Item
9.5.1	DS-3 input
9.5.2	DS-1/DS-1C/DS-2 input
9.5.3	Unipolar input
9.5.4	Pattern and frame
9.5.5	Measurement
9.5.6	STATUS LED
9.5.7	Printer (OPT 11)
9.5.8	Jitter measurement (OPT 02)

9.2 Equipment Required for Performance Check

Tables 9-3 and 9-4 list the equipment required for the performance check, the performance requirements and the reference paragraph numbers.

Table 9-3 Equipment Required for Performance Check (Transmitter)

Equipment	Specifications	Application (Paragraph)
Frequency counter MF57A	Frequency range: 1 to 50 MHz Resolution: 1 Hz Stability: $\leqq 2 \times 10^{-8}$/day Input impedance: $\geqq 1$ MΩ	9.4.1 9.4.2
Signal generator (1)	Frequency range: 1 to 50 MHz Resolution: 1 kHz Impedance: 75 Ω	9.4.2
Pulse generator MG418A	Frequency range: 1 Hz to 10 MHz Level: TTL	9.4.5
Signal generator (2)	Frequency range: 1 Hz to 10 MHz Level: 0 to 4 Vp-p	9.4.11
Universal counter	Frequency range: 10 Hz to 50 MHz Input impedance: $\geqq 1$ MΩ Arithmetic function	9.4.3 9.4.4 9.4.10
Oscillo-scope	Frequency band: DC to 300 MHz Channels: 2 Vertical sensitivity: 50 mV to 5 V/div Sweep time: 5 ns to 0.2 s/div Input impedance: $\geqq 1$ MΩ	9.4.2 9.4.6 9.4.7 9.4.8 9.4.9 9.4.11
DC regulated power supply	DC -5.2 V, $\geqq 50$ mA Used with ECL level converter	9.4.8

Table 9-3 Equipment Required for Performance Check (Transmitter)

(continued)

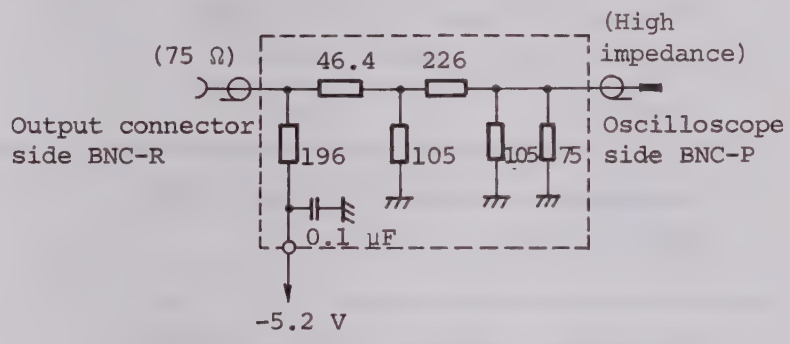
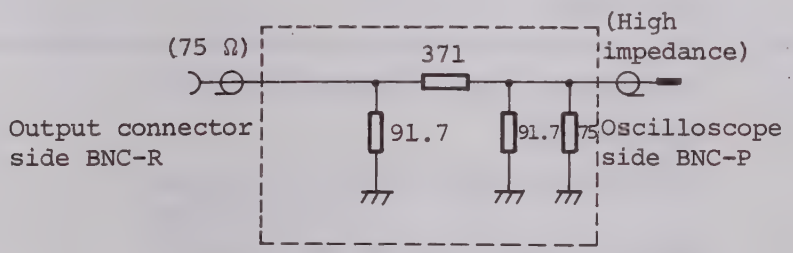
Equipment	Specifications	Application (Paragraph)
ME3401A Receiver	See Table 2-5.	9.4.5
ECL level converter	Frequency band: DC to 300 MHz Input/output voltage ratio: 10:1 	9.4.8
Terminator with 20 dB attenuation	Frequency band: DC to 300 MHz Input/output voltage ratio: 10:1 Impedance: 75 Ω 	9.4.1 9.4.2 9.4.3 9.4.4 9.4.6 9.4.7 9.4.8 9.4.9 9.4.10 9.4.11
Pulse Pattern Generator	Frequency band: DC to 50 MHz Level : TTL, ECL Impedance : 75 Ω	9.4.2 9.4.10

Table 9-3 Equipment Required for Performance Check (Transmitter)

(continued)

Equipment	Specifications	Application (Paragraph)
100 Ω/75 Ω Impedance converter	Frequency band: DC to 10 MHz	9.4.7
110 Ω/75 Ω Impedance converter	Frequency band: DC to 10 MHz	9.4.7
Jitter measuring instrument	Measurement frequency: 1.544 MHz 3.152 MHz 6.312 MHz 44.736 MHz Maximum measurable jitter amplitude : 16.2 UIp-p	9.4.11

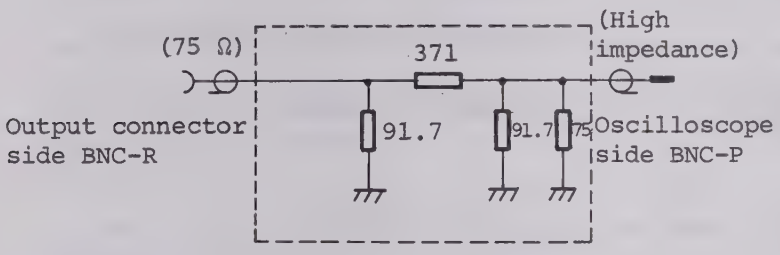
Table 9-4 Equipment Required for Performance Check (Receiver)

Equipment	Specifications	Application (Paragraph)
ME3401A Transmitter	See Table 2-6.	9.5.1 9.5.2 9.5.3 9.5.4 9.5.5 9.5.6 9.5.7 9.5.8
Resistance attenuator (1) MN64B	Frequency range: DC to 300 MHz Attenuation: 0 to 40 dB in 1 dB steps Input impedance: 75 Ω	9.5.1
Resistance attenuator (2)	Frequency range: DC to 10 MHz Attenuation: 0 to 10 dB in 1 dB steps	9.5.2
Artifical line (1)	Equivalent to 655 ft of ABAM cable Frequency: 1.544 MHz	9.5.2
Artifical line (2)	Equivalent to 1000 ft of ABAM cable Frequency: 3.152 MHz	9.5.2
Oscilloscope	Frequency band: DC to 300 MHz Channels: 2 Vertical sensitivity: 50 mV to 5 V/div Sweep time: 5 ns to 0.2 s/div Input impedance: ≧1 MΩ	9.5.8

Table 9-4 Equipment Required for Performance Check (Receiver)

(continued)

Equipment	Specifications	Application (Paragraph)
Terminator with 20 dB attenuation	Frequency band: DC to 300 MHz Input/output voltage ratio: 10:1 Impedance: 75 Ω	9.5.8



9.3 Preparations

1. Initialize the ME3401A.
2. Warm-up the ME3401A and all measuring equipment for at least 30 minutes.

9.4 Transmitter Performance Check Procedure

9.4.1 Internal clock

(1) Specifications

Frequency : 1.544 MHz
3.152 MHz
6.312 MHz
44.736 MHz

Accuracy : ≦±10 ppm
After 30 minutes operation

(2) Setup (Use 75 Ω coaxial cable.)

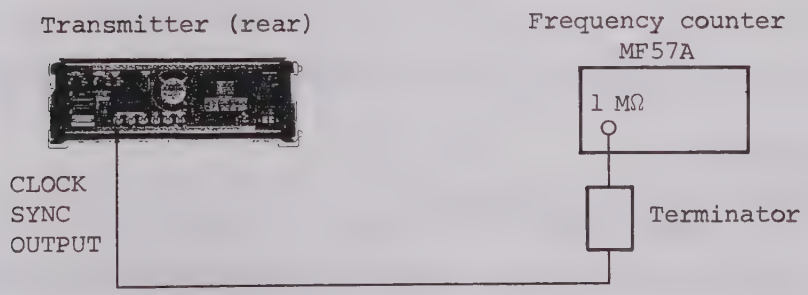


Fig. 9-1 Internal Clock

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-1.
2	Set the [CLOCK] key to DS-3.
3	Read the frequency measured by the MF57A and check that it is within the range shown in the table below.
4	Set the [CLOCK] key to DS-2, DS-1C, and DS-1, and check that each frequency is within the range shown in the table below.

CLOCK	Allowable frequency range (MHz)
DS-3	44.735560 to 44.736440
DS-2	6.311937 to 6.312063
DS-1C	3.151969 to 3.152031
DS-1	1.543985 to 1.544015

9.4.2 External clock

(1) Specifications

Frequency range : DS-3 1 to 50 MHz
DS-2, DS-1C, DS-1 } 1 to 10 MHz

Input level and waveform : TTL Square wave
(High: +2.4 to +5 V
Low : -0.2 to +0.4 V)

0.7 to 1.5 Vp-p Sine wave and square wave

ECL Square wave

Termination : TTL, 0.7 to 1.5 Vp-p GND
ECL nominal -1.3 V

(2) Setup (Use 75 Ω coaxial cable.)

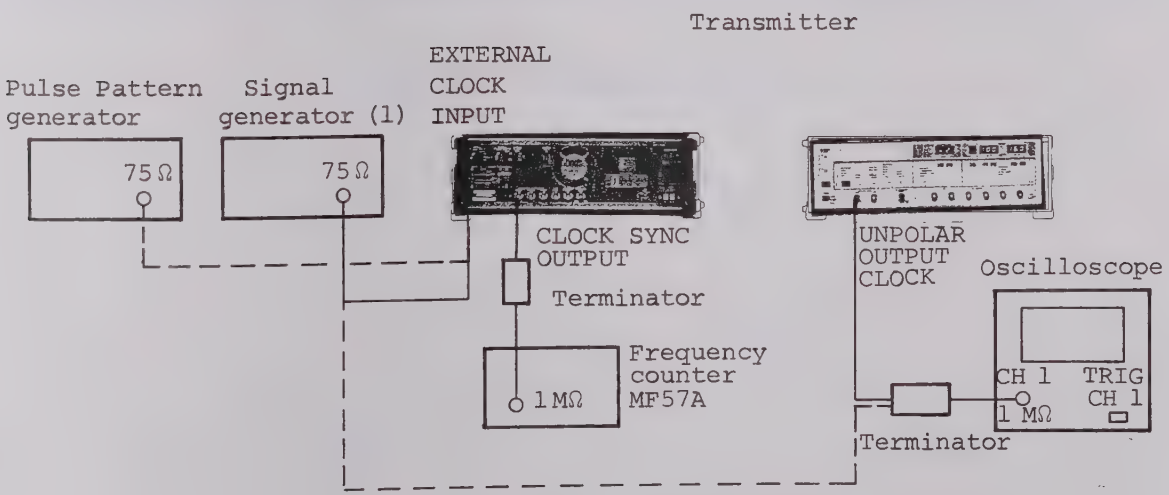


Fig. 9-2 External Clock

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown by the solid line in Fig. 9-2.
2	Set the ME3401A transmitter as follows: CLOCK : EXTERNAL EXTERNAL CLOCK INPUT LEVEL (Rear panel) : 0.7-1.5Vp-p UNIPOLAR OUTPUT LEVEL (Rear panel) : +1/-1V FUNCTION SWITCH A: A1 = 0, A2 = 0 (Rear panel)
3	Set the oscilloscope trigger mode to internal, CH1.
4	Connect the signal generator (1) output to CH1 of the oscilloscope as shown by the dotted line in Fig. 9-2, and set the output level to the upper and lower limits of the specification. (See Fig. 9-3.)
5	Connect the signal generator (1) output to the EXTERNAL CLOCK INPUT of the ME3401A transmitter.
6	Set the signal generator (1) output frequency to the upper and lower limits of the specification. (See Fig. 9-3.)
7	Check that: a) The counter reading (clock frequency) and signal generator (1) output frequency are the same.

(continued)

Step	Procedure
7 (cont.)	Check that: (cont.)
	b) The oscilloscope CH1 clock output waveform is normal (See Fig. 9-4.)
8	Connect the transmitter EXTERNAL CLOCK INPUT connector to the pulse pattern generator clock output connector.
9	Set the EXTERNAL CLOCK INPUT LEVEL of the transmitter and OUTPUT LEVEL of the pulse pattern generator to TTL.
10	Check that the frequency counter displayed value and the pulse pattern generator output frequency are the same.
11	Set the EXTERNAL CLOCK INPUT LEVEL of the transmitter and OUTPUT LEVEL of the pulse pattern generator to ECL.
12	Check that the frequency counter displayed value and the pulse pattern generator output frequency are the same.

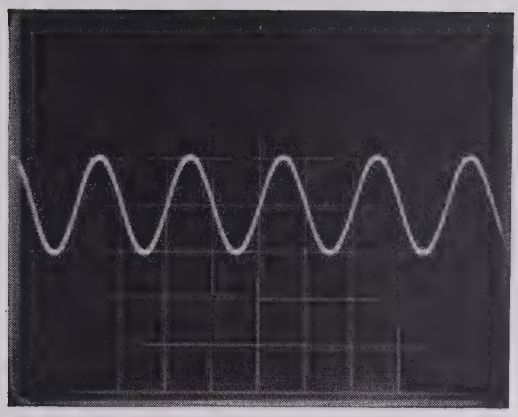


Fig. 9-3 External CLOCK Input Waveform

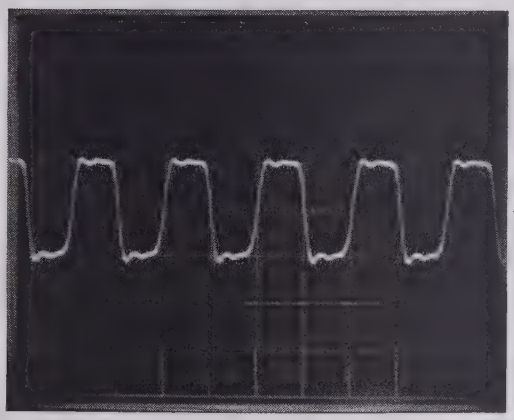


Fig. 9-4 External CLOCK Output Waveform (+1V/-1V)

9.4.3 Pattern

(1) Specifications

2^{15}-1 (32767 bit period)

2^{20}-1 (1048575 bit period)

2^{23}-1 (8388607 bit period)

1100 (4 bit period)

1010 (2 bit period)

1000 (4 bit period)

(2) Setup (User 75 Ω coaxial cable.)

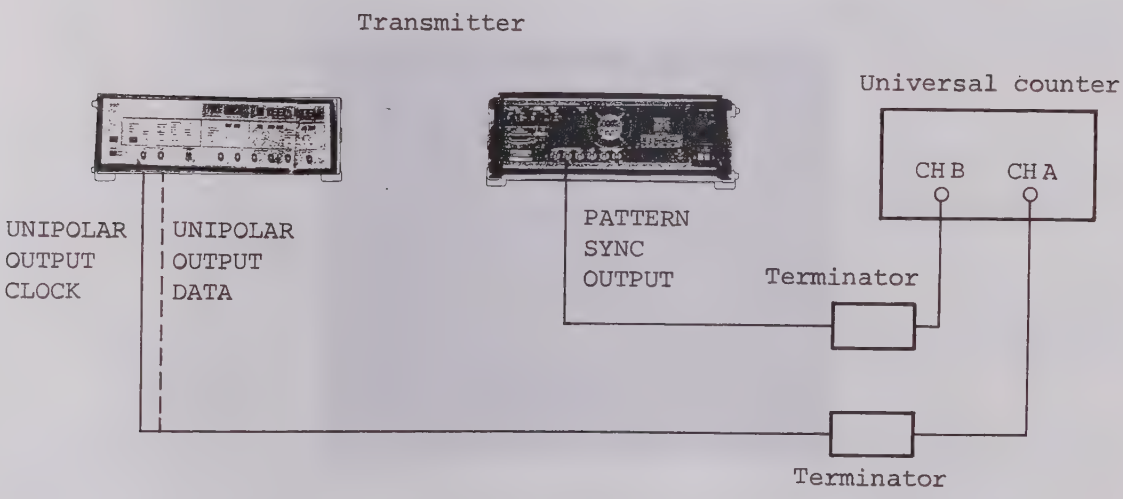


Fig. 9-5 Pattern

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown by the solid line in Fig. 9-5.
2	Set the ME3401A transmitter as follows: CLOCK : DS-3 FRAMED : UNFRAMED PATTERN : PRBS ERROR ADDITION : OFF JITTER : OFF UNIPOLAR OUTPUT LEVEL (Rear panel) : +1/-1V FUNCTION SWITCH A: A3 = 0 (Rear panel)
3	Set the universal counter function switch to the A/B ratio.
4	Switch [CLOCK] to DS-3 (PRBS 2^{15}-1), DS-2 (PRBS 2^{20}-1), DS-1C (PRBS 2^{20}-1), and DS-1 (PRBS 2^{20}-1) successively, and check that the values shown in Table 9-5 are displayed on the universal counter.
5	Set [CLOCK] to DS-3 and set the rear-panel FUNCTION SWITCH to A3 = 1 (PRBS 2^{23}-1). Check that the values shown in Table 9-5 are displayed on the universal counter.

(continued)

Step	Procedure
6	Switch [PATTERN] to 1100, 1010, and 1000 successively and check that the values shown in Table 9-5 are displayed on the universal counter.
7	Disconnect the cable connected to the UNIPOLAR OUTPUT CLOCK connector and connect it to the UNIPOLAR OUTPUT DATA connector.
8	Repeat steps 4, 5, and 6, and check that the values shown in Table 9-6 are displayed on the universal counter.

Table 9-5 Number of Clock Pulses

Set pattern	Universal counter displayed value
PRBS 2^{15}-1 (DS-3)	65534
PRBS 2^{23}-1 (DS-3)	16777214
PRBS 2^{20}-1 (DS-2)	2097150
PRBS 2^{20}-1 (DS-1C)	2097150
PRBS 2^{20}-1 (DS-1)	2097150
1100	8
1010	8
1000	8

Table 9-6 Number of Ones in DATA

Set pattern	Universal counter displayed value
PRBS 2^{15}-1 (DS-3)	16384
PRBS 2^{23}-1 (DS-3)	4194304
PRBS 2^{20}-1 (DS-2)	524288
PRBS 2^{20}-1 (DS-1C)	524288
PRBS 2^{20}-1 (DS-1)	524288
1100	2
1010	4
1000	2

9.4.4 Frame

(1) Specifications

DS-3, DS-2, DS-1C, and DS-1 (D4, ESF) frames conform to Bell Standards.

For more information:

(a) DS-1 (D4) frame

See Fig. 5-7.

(b) DS-1 (ESF) frame

See Fig. 5-8.

(c) DS-1C/DS-2 frame

See Fig. 5-6.

(d) DS-3 frame

See Fig. 5-4.

(2) Setup (Use 75 Ω coaxial cable.)

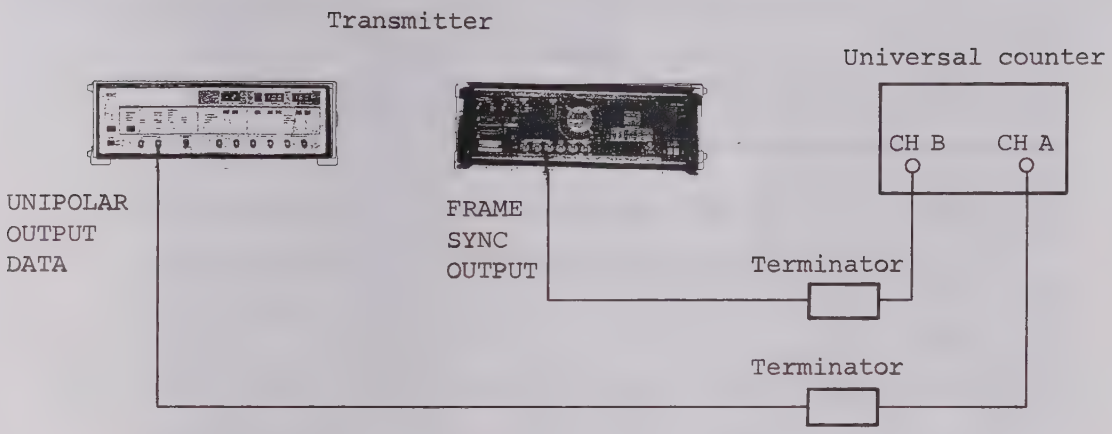


Fig. 9-6 Frame

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-6.
2	Set the ME3401A transmitter is follows:
	CLOCK : DS-3
	FRAME : FRAMED
	PATTERN : 1111
	ERROR ADDITION : OFF
	JITTER : OFF
	UNIPOLAR OUTPUT LEVEL (Rear panel) : +1/-1V

(continued)

Step	Procedure
3	Set the universal counter function switch to the A/B ratio.
4	Switch [CLOCK] to DS-3, DS-2, DS-1C, and DS-1 successively and check that the values shown in Table 9-7 are displayed on the universal counter.

Table 9-7 Number of Frame Pulse

Clock	Universal counter displayed value
DS-3	32
DS-2	17
DS-1C	17
DS-1 (D4 or ESF)	6

9.4.5 Error addition

(1) Specifications

Error: Bit error, frame error, parity error (DS-3), CRC-6 error (DS-1 ESF)

Internal error : 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}, 10^{-9}, single error

External error : Single error, burst error

Pulse width $\geqq$200 ns and $\geqq$10 bits

TTL level

(2) Setup (Use 75 Ω coaxial cable.)

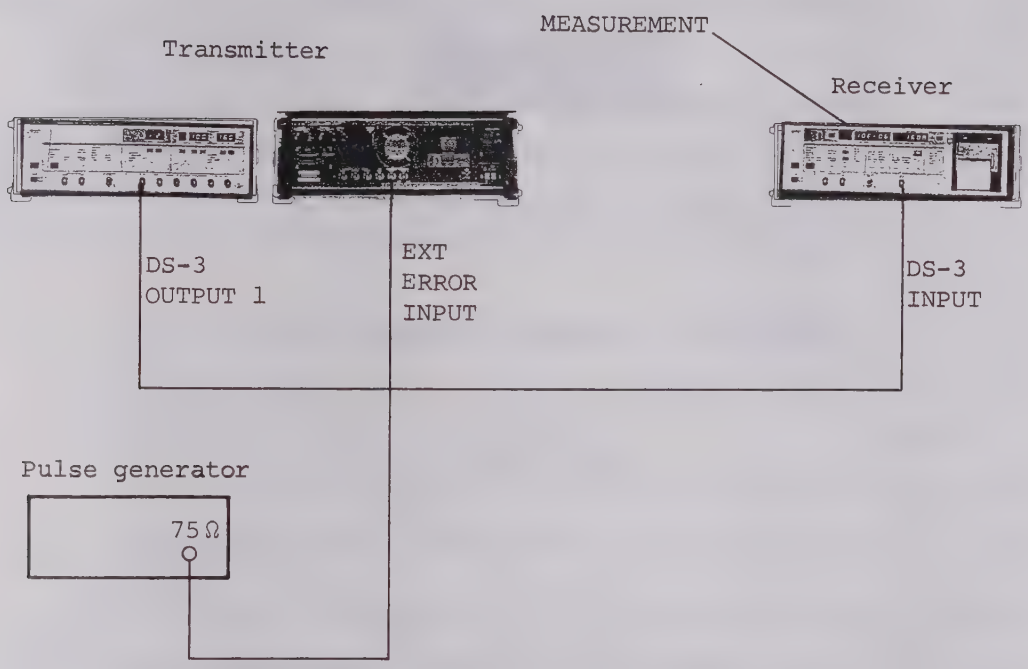


Fig. 9-7 Error Addition

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-7.
2	Set the ME3401A transmitter as follows: CLOCK : DS-3 FRAME : FRAMED PATTERN : PRBS

(continued)

Step	Procedure	
2 (cont.)	DS-3 LEVEL	: DSX-3
	JITTER	: OFF
	FUNCTION SWITCH A (Rear panel)	: Set to all "0".
3	Set the ME3401A receiver as follows:	
	INPUT	: DSX-3 H/L
	FRAME	: FRAMED
	DEMUX	: OFF
	PATTERN	: PRBS
	MEASUREMENT DISPLAY	: ER RATE
	ERROR	: BIT
	TIME DISPLAY	: TIMED
	TIME MODE	: REPEAT
	PULSE/CONT	: CONT
	START/STOP	: START
	JITTER	: OFF
	BUZZER	: OFF
	PRINT	: OFF
	FUNCTION SWITCHes A, B, and C (Rear panel)	: Set to all "0".

(continued)

Step	Procedure
4	Internal error addition check
	(a) Set [ERROR ADDITION] of the ME3401A transmitter to ERROR RATE, and set 10^{-2}, 10^{-3}, 10^{-4}, --- 10^{-9} with the [⩔], [⩓] keys and set to SINGLE with the SINGLE key.
	(b) check that the transmitter ERROR ADDITION value and receiver measured results are within the range shown in Table 9-8.

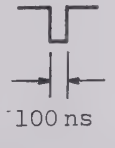
Table 9-8 Error Addition

Transmitter	Receiver		
ER ADDITRION	ER RATE	Measuring time	Remarks
SINGLE	2.0×10^{-8} to 2.3×10^{-8}		
10^{-2}	9.5×10^{-3} to 1.05×10^{-2}		
10^{-3}	9.5×10^{-4} to 1.05×10^{-3}	1 second	
10^{-4}	9.5×10^{-5} to 1.05×10^{-4}		
10^{-5}	9.5×10^{-6} to 1.05×10^{-5}		
10^{-6}	9.5×10^{-7} to 1.05×10^{-6}		
10^{-7}	9.5×10^{-8} to 1.05×10^{-7}	5 seconds	Change the measuring time. For the change method, refer to Table 3-3, #11 in paragraph 3.2.2.
10^{-8}	9.5×10^{-9} to 1.05×10^{-8}	5 minutes	
10^{-9}	9.5×10^{-10} to 1.05×10^{-9}	30 minutes	

(continued)

Step	Procedure
5	External error addition check
	(a) Set [ERROR ADDITION] of the ME3401A transmitter to EXTERNAL.
	(b) Apply the signal shown in Table 9-9 from the pulse generator to the ME3401A transmitter EXT ERROR INPUT connector.
	(c) Check that the ME3401A receiver measured result is within the range shown in Table 9-9.

Table 9-9 External Error

ME3401A Transmitter EXTERNAL ERROR (Function SWITCH A setting)	Pulse generator				ME3401A Receiver ERROR RATE value
	Frequency	Pulse width	Output level	Pulse polarity	
SINGLE (A6 = 0)	1 kHz	500 µs	TTL		2.0×10^{-5} to 2.4×10^{-5}
BURST (A6 = 1)	1 kHz	100 ns	TTL		7.0×10^{-5} to 1.0×10^{-4}

9.4.6 DS-3 OUTPUT

(1) Specifications

Code : B3ZS, AMI (The AMI can only be set for the 1000 pattern.)

Waveform level :

DS-3 High

Amplitude : 0.91 V0-p ±0.1 V

Pulse width : 11.2 ±1.1 ns
(at half amplitude)

Rise/fall time : 4.5 ±1.5 ns

Overshoot/undershoot : ≦10% of amplitude

DSX-3

High output connected in series to equivalent of 450 ft of 728A cable (Fig. 2-3)

DS-3 Low

CH1 to CH5 : 0.186 V0-p nominal
(13.8 dB lower than high level)

CH6 : High output connected in series to equivalent of 900 ft of 728A cable

(2) Setup (Use 75 Ω coaxial cable.)

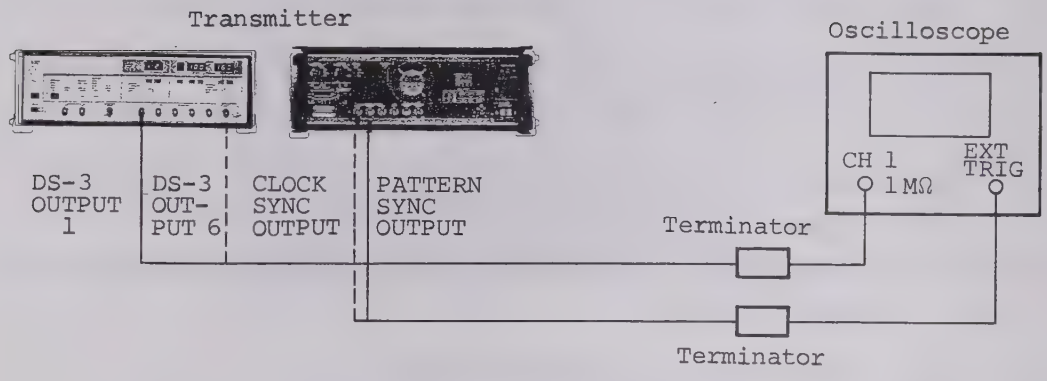


Fig. 9-8 DS-3 Output

(3) Procedure

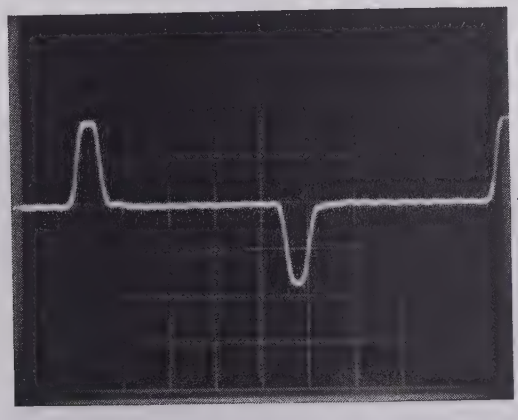
Step	Procedure
1	Set-up the equipment as shown by the solid line in Fig. 9-8.
2	Set the ME3401A transmitter as follows:
	CLOCK : DS-3
	FRAME : OFF
	PATTERN : 1000
	DS-3 LEVEL : HIGH
	ERROR ADDITION : OFF
	JITTER : OFF
	FUNCTION SWITCH A (Rear panel) : A3 = 0 A4 = 1

(continued)

Step	Procedure
3	B3ZS code check
	(a) Check that the AMI code waveform shown in Fig. 9-9 (a) is displayed on the oscilloscope.
	(b) Set A4 of FUNCTION SWITCH A to "0", and check that the waveform on the oscilloscope is converted to the B3ZS code waveform shown in Fig. 9-9 (b).
4	DS-3 HIGH output waveform check
	(a) Connect the oscilloscope EXT TRIG connector to the ME3401A transmitter CLOCK SYNC OUTPUT connector.
	(b) Set [PATTERN] to PRBS.
	(c) Check that the waveform shown in Fig. 9-10 is displayed on the oscilloscope.
5	DSX-3 output waveform check
	(a) Set [DS-3 LEVEL] to DSX-3, [PATTERN] to 1000, and A4 of FUNCTION SWITCH A to "1".
	(b) Check that the waveform displayed on the oscilloiscope satisfies the pulse mask shown in Fig. 2-3.
6	DS-3 LOW output waveform check
	(a) Set [DS-3 LEVEL] to LOW and [PATTERN] to PRBS.
	(b) Check that the waveform shown in Fig. 9-11 is displayed on the oscilloscope.

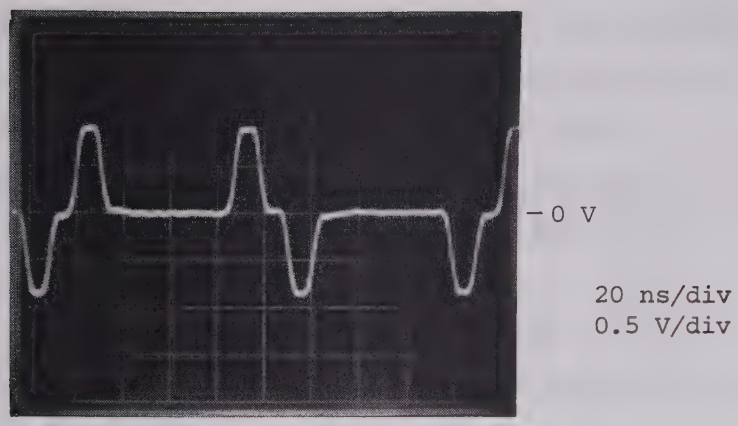
(continued)

Step	Procedure
7	Output waveform check through 900 ft 728A code (a) Connect the oscilloscope CH1 connector to the ME3401A transmitter DS-3 OUTPUT 6 connector. (b) Check that the waveform shown in Fig. 9-12 is displayed on the oscilloscope.



(a) DS-3 AMI Code (1000)

Fig. 9-9 B3ZS Code Check



(b) DS-3 B3SZ Code (1000)

Fig. 9-9 B3ZS Code Check (Continued)

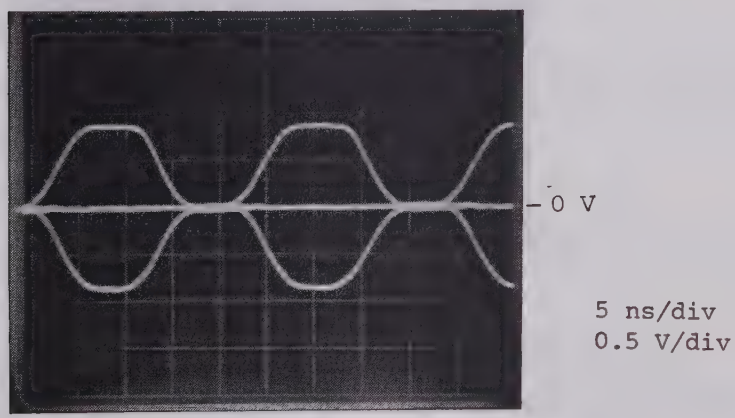


Fig. 9-10 DS-3 HIGH Output Waveform

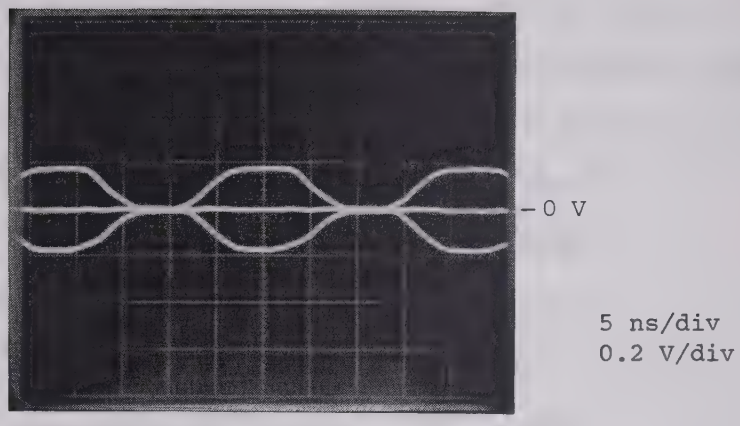


Fig. 9-11 DS-3 Low Output Waveform

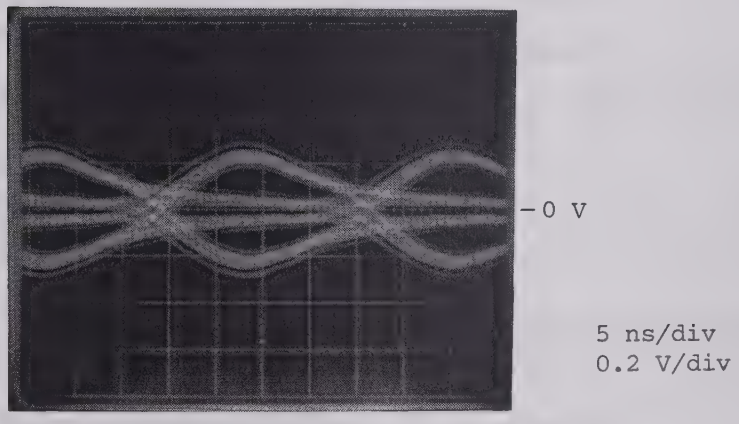


Fig. 9-12 DS-3 Output Waveform Passed Through 900 ft of 728A Cable

9.4.7 DS-1/DS-1C/DS-2 OUTPUT

(1) Specifications

(a) DS-1 output

Code : AMI, B8ZS

Level : 3 V0-p

Waveform : Satisfies Fig. 2-1 conditions

(b) DS-1C output

Code : AMI

Level : 3 ±0.3 V0-p

(c) DS-2 output

Code : B6ZS

Waveform, level

DS-2 High: 2.1 ±0.25 V0-p

DSX-2: High output connected in series to equivalent of 1000 pf of ABAM cable (Fig. 2-2)

(2) Setup (Use 75 Ω coaxial cable.)

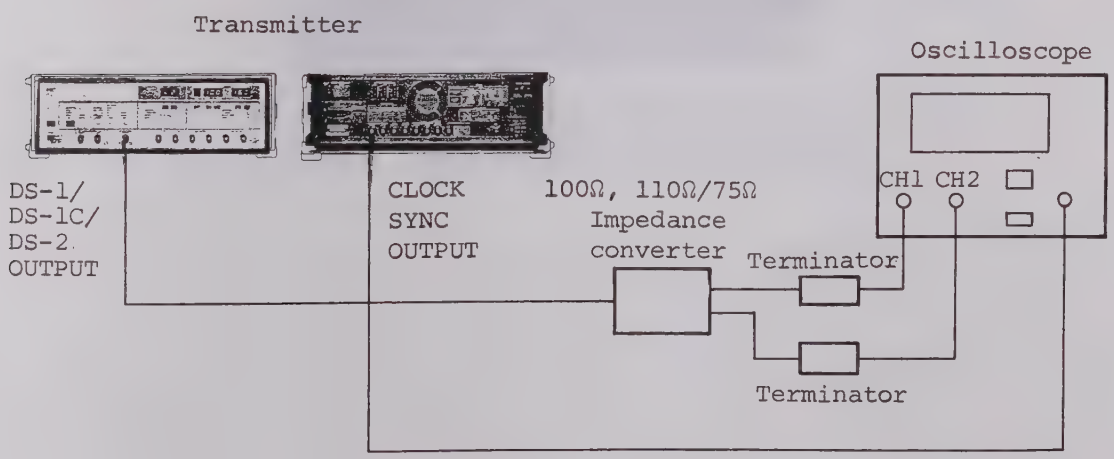


Fig. 9-13 DS-1/DS-1C/DS-2 Output

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-13.
2	Set the ME3401A transmitter as follows: CLOCK : DS-1 DS-1 CODE : AMI FRAME : OFF PATTERN : PRBS ERROR ADDITION : OFF JITTER : OFF
3	DS-1 output waveform check (a) Check that the waveform shown in Fig. 9-14 is displayed on the oscilloscope.
4	DS-1C output waveform check (a) Set [CLOCK] to DS-1C. (b) Check that the waveform shown in Fig. 9-15 is displayed on the oscilloscope.
5	DSX-2 output waveform check (a) Set [CLOCK] to DS-2, and A5 of FUNCTION SWITCH A to "0". (b) Check that the waveform displayed on the oscilloscope satisfies the pulse mask shown in Fig. 2-2.

(continued)

Step	Procedure
6	DS-2 output waveform check (a) Set [CLOCK] to DS-2, and A5 of FUNCTION SWITCH A to "1". (b) Check that the waveform shown in Fig. 9-16 is displayed on the oscilloscope.

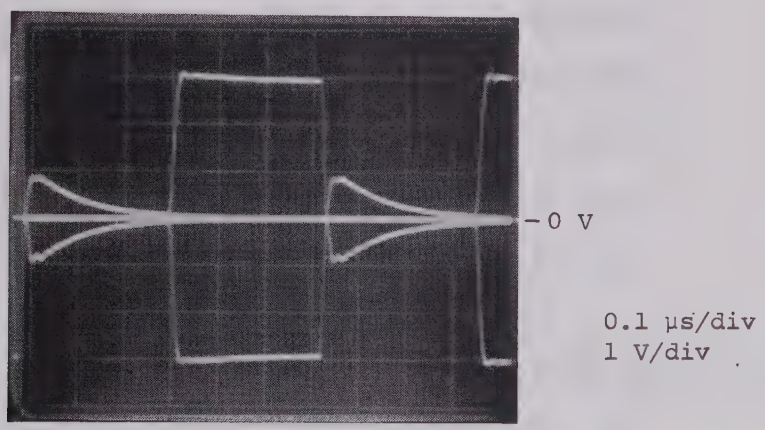


Fig. 9-14 DS-1 Output Waveform

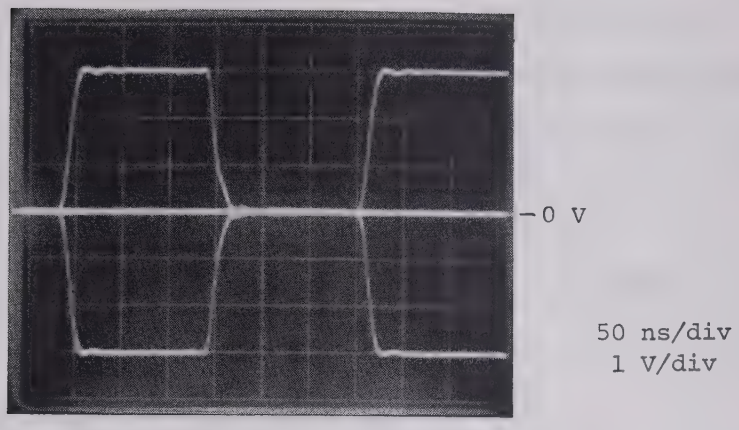


Fig. 9-15 DS-1C Output Waveform

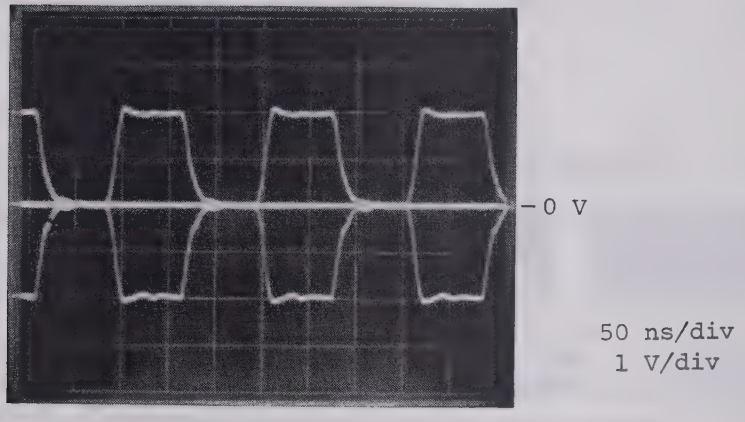


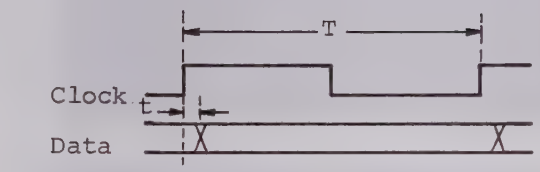
Fig. 9-16 DS-2 Output Waveform

9.4.8 Unipolar output

(1) Specifications

Level : TTL
+1/-1 V
ECL

Phase :



$|t| \leq$ (10% of T) + 1 ns

(2) Setup (Use 75 Ω coaxial cable.)

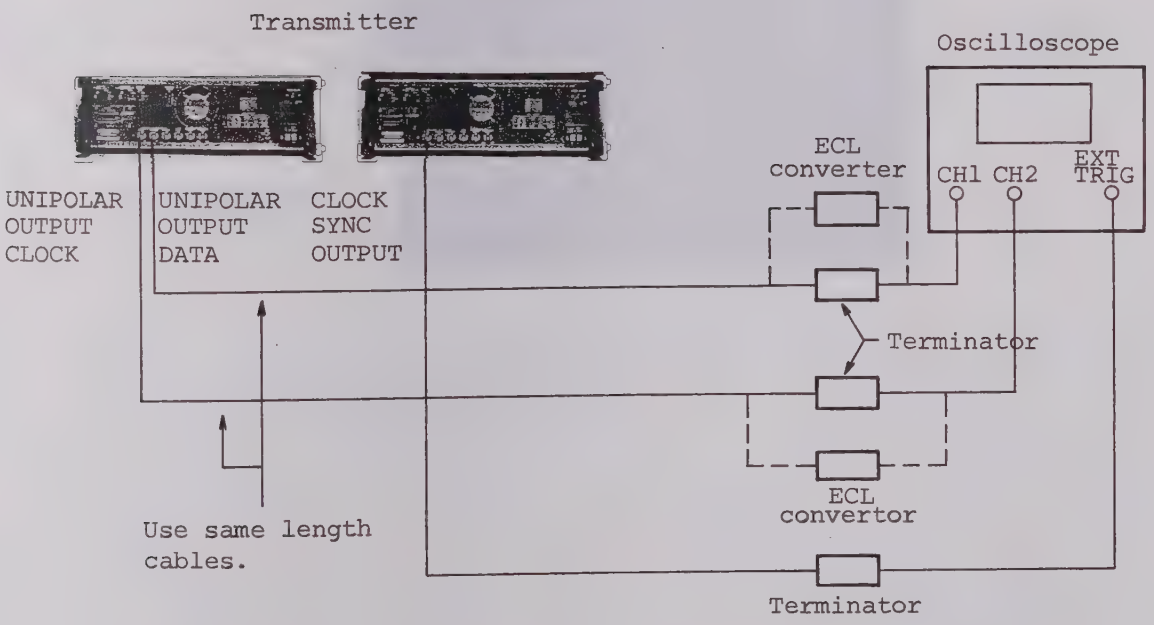


Fig. 9-17 Unipolar Output

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-17.
2	Set the ME3401A transmitter as follows: CLOCK : DS-3 FRAME : OFF PATTERN : PRBS ERROR ADDITION : OFF JITTER : OFF UNIPOLAR OUTPUT LEVEL (Rear panel) : TTL
3	TTL output waveform check (a) Check that the oscilloscope CH1 and CH2 waveform and phase relationship satisfy the conditions shown in Fig. 9-18.
4	+1/-1 V output waveform check (a) Set UNIPOLAR OUTPUT LEVEL on the rear panel to +1/-1V. (b) Check that the oscilloscope CH1 and CH2 waveform and phase relationship satisfy the conditions shown in Fig. 9-19.
5	ECL output waveform check (a) Set UNIPOLAR OUTPUT LEVEL on the rear panel to ECL, and replace the terminator shown in Fig. 9-17 with the ECL level converter. (b) Check that the oscilloscope CH1 and CH2 waveform and phase relationship satisfy the conditions shown in Fig. 9-20.

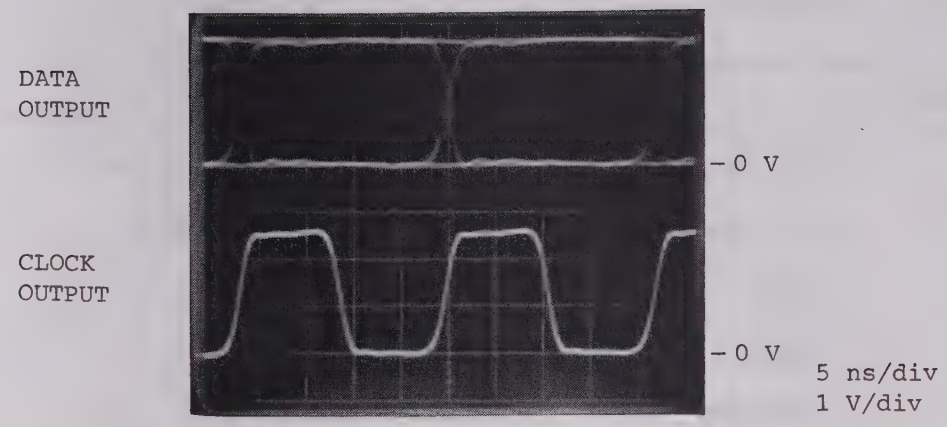


Fig. 9-18 TTL Output Waveform

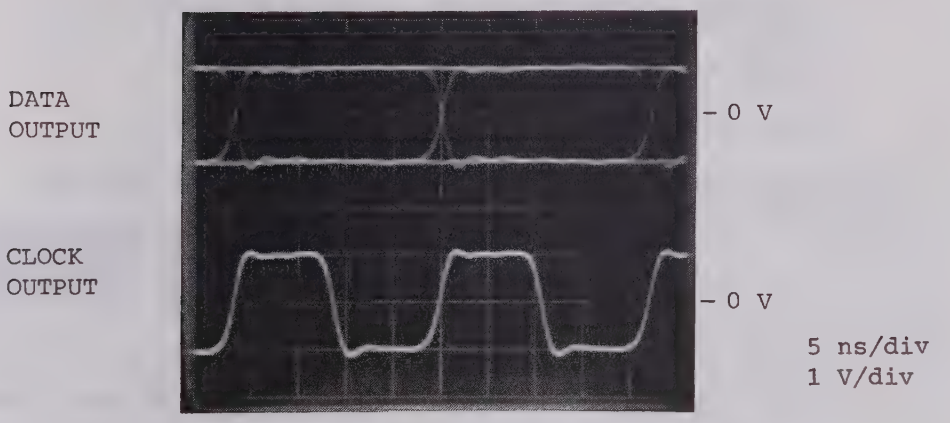


Fig. 9-19 +1/-1 V Output Waveform

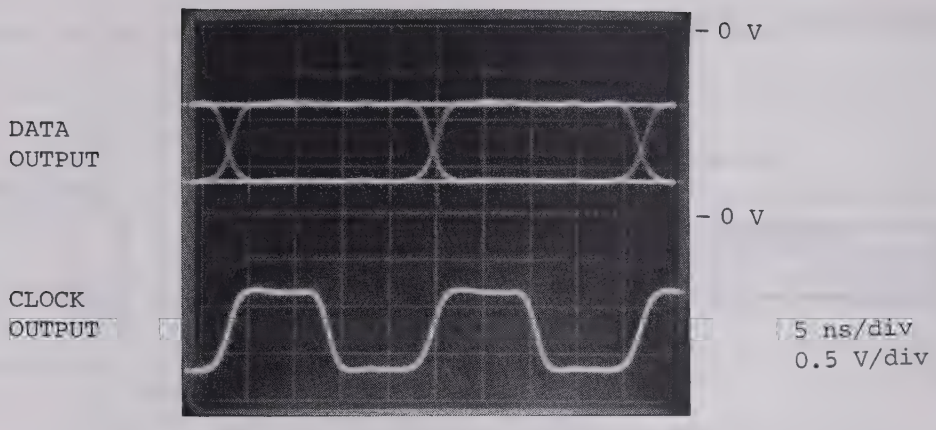


Fig. 9-20 ECL Output Waveform

9.4.9 X-bit input

(1) Specifications

Interface : TTL

High : DS-1 (ESF), DS-1C, DS-2,
DS-3 --- X = 1
DS-1 (D4) --- X = 0

Low : DS-1 (ESF), DS-1C,
DS-2, DS-3 --- X = 0
DS-1 (D4) --- X = 1

(2) Setup (Use 75 Ω coaxial cable.)

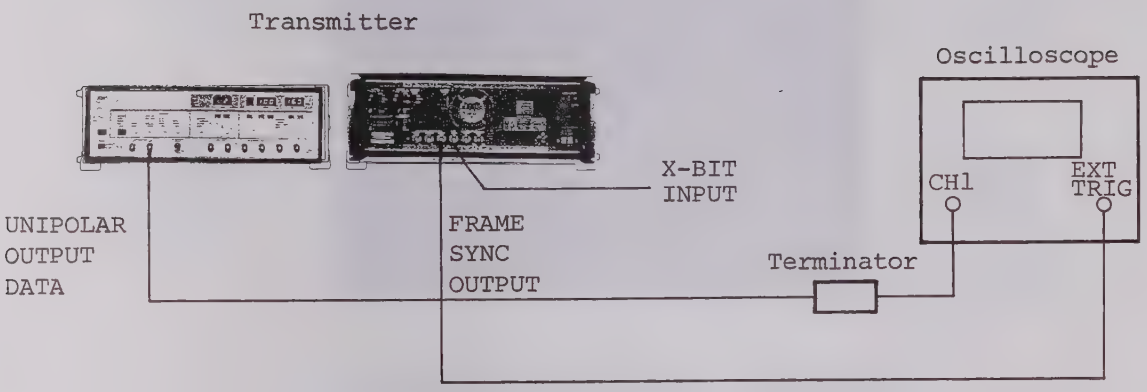


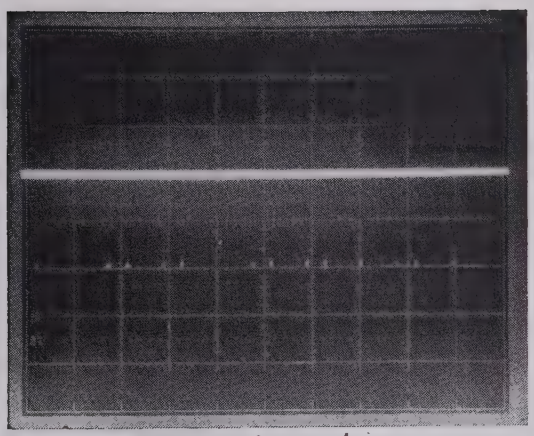
Fig. 9-21 X-bit Input

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-21.
2	Set the ME3401A transmitter as follows:
	CLOCK : DS-3
	FRAME : FRAMED
	PATTERN : 1111
	ERROR ADDITION : OFF
	JITTER : OFF
	UNIPOLAR OUTPUT LEVEL : +1/-1V (Rear panel)

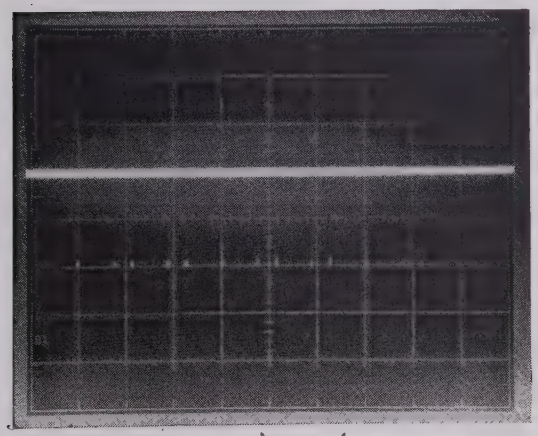
(continued)

Step	Procedure
3	DS-3 X-bit check (a) Ground the ME3401A transmitter rear-panel X-bit connector. (b) Check that the oscilloscope waveform changes from that shown in Fig. 9-22 (a) to that in Fig. 9-22 (b).
4	Set [CLOCK] to DS-2, DS-1C, and DS-2, successively and repeat step 3(a).
5	Check that the oscilloscope waveform changes as shown in: Fig. 2-23 for DS2 Fig. 2-24 for DS-1C Fig. 2-25 and 2-26 for DS-1



5 μs/div
1 V/div

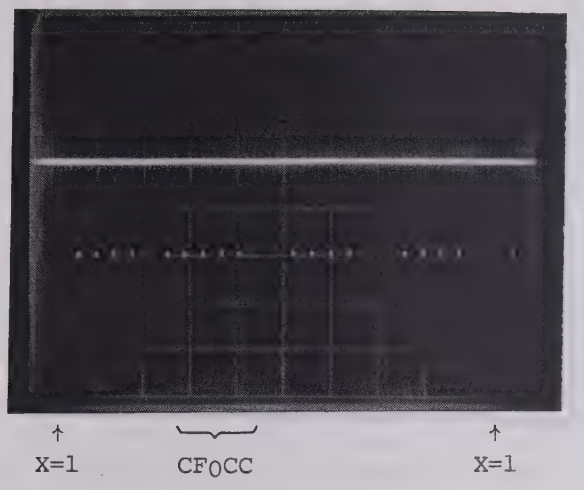
(a) Frame X-bit = 1



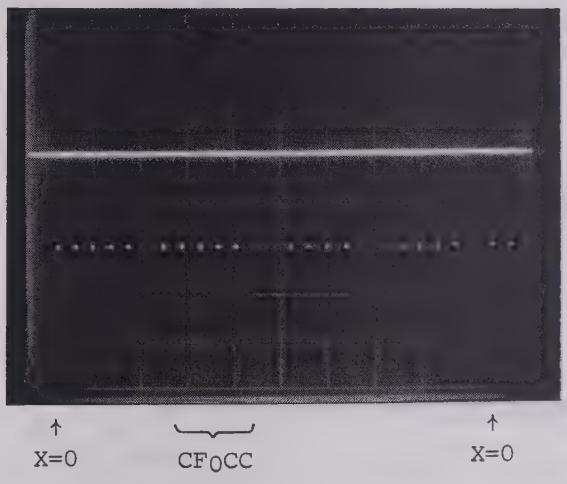
5 μs/div
1 V/div

(b) Frame X-bit = 0

Fig. 9-22 DS-3 X-bit

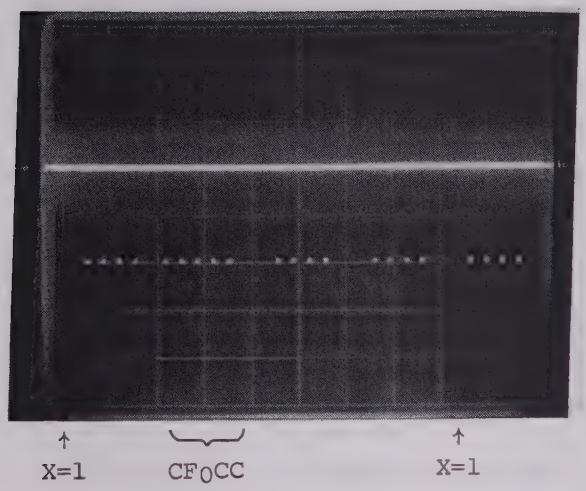


(a) Frame X-bit = 1



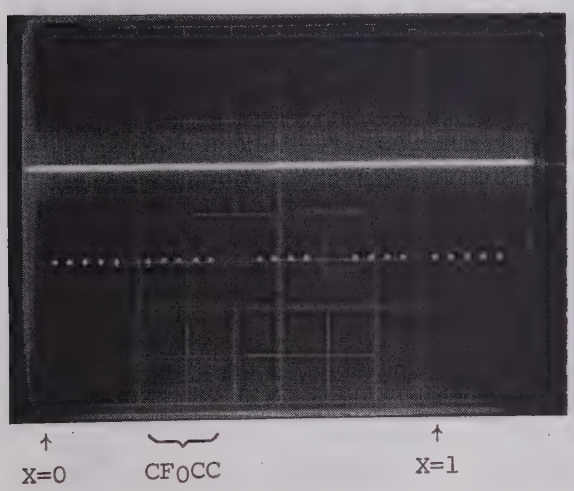
(b) Frame X-bit = 0

Fig. 9-23 DS-2 X-bit



50 µs/div
1 V/div

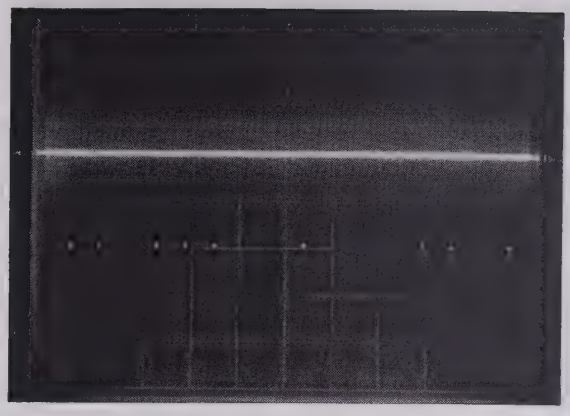
(a) Frame X-bit = 1



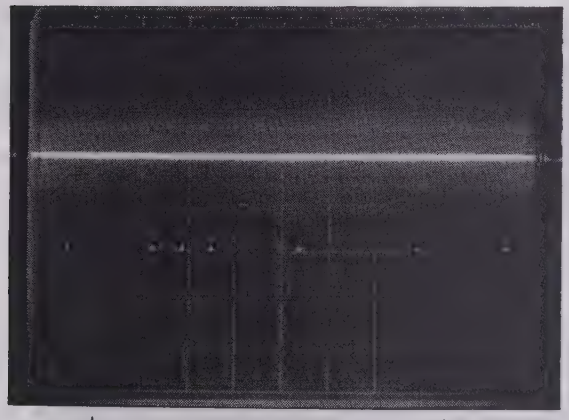
50 µs/div
1 V/div

(b) Frame X-bit = 0

Fig. 9-24 DS-1C X-bit

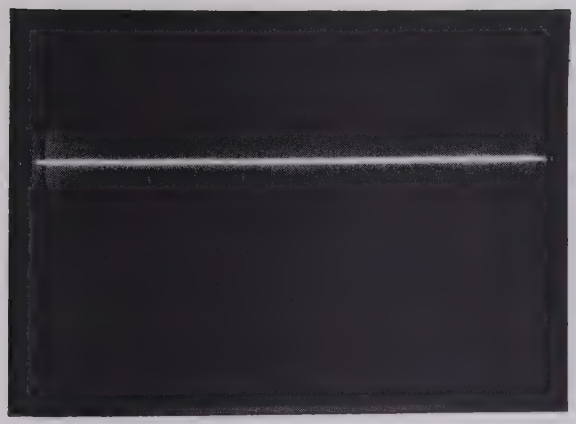


(a) Frame S-bit = 1



(b) Frame S-bit = 1

Fig. 9-25 DS-1 (D4) S-bit



500 µs/div
1 V/div

↑
m=1

(a) Frame m-bit = 1

500 µs/div
1 V/div

↑
m=0

(b) Frame m-bit = 0

Fig. 9-26 DS-1 (ESF) m-bit

9.4.10 External data

(1) Specifications

FREQUENCY RANGE : 1 to 50 MHz

INPUT LEVEL : TTL, ECL

IMPEDANCE : 75 Ω

TERMINATION : TTL GND
ECL nominal -1.3 V

(2) Setup (Use 75 Ω coaxial cable.)

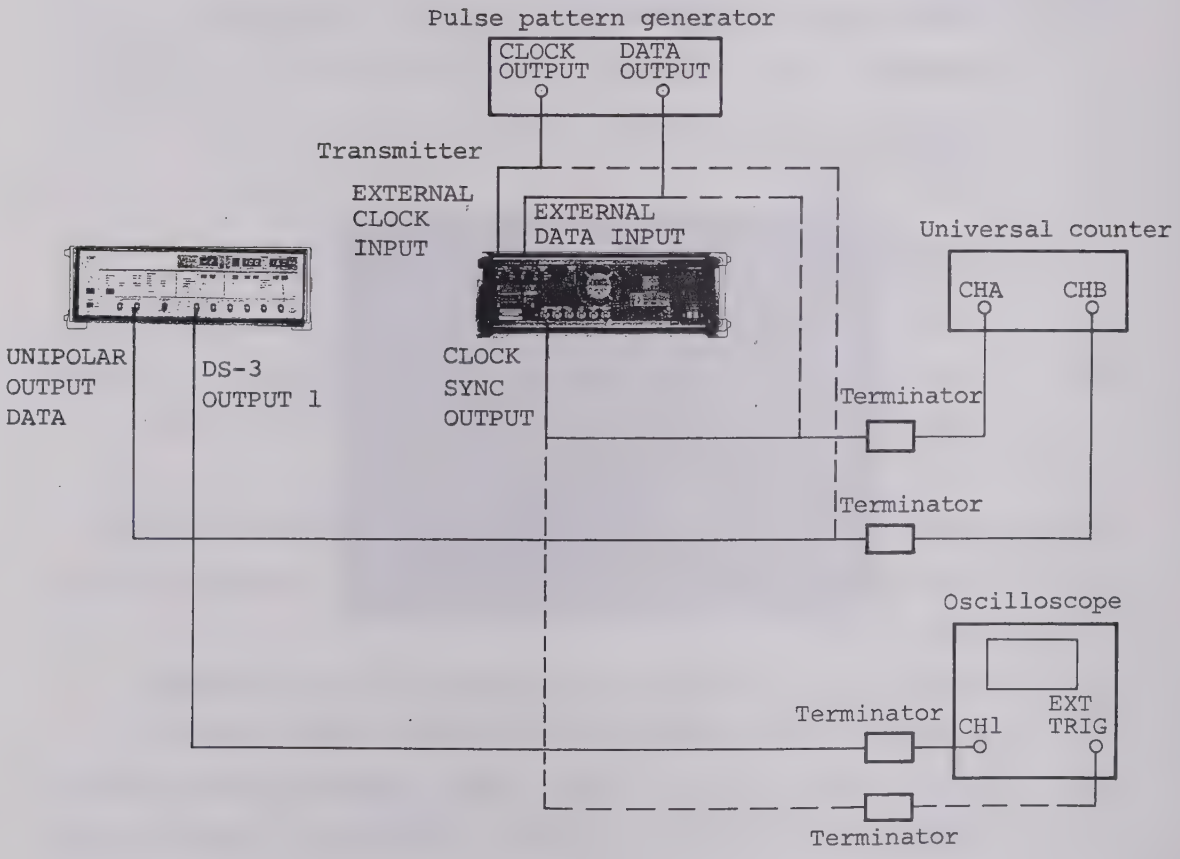


Fig. 9-27 External Data

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown by the solid line in Fig. 9-27.
2	Set the ME3401A transmitter as follows: CLOCK : EXTERNAL FRAME : UNFRAMED PATTERN : EXTERNAL DS-3 LEVEL : HIGH ERROR ADDITION : OFF JITTER : OFF EXTERNAL CLOCK INPUT LEVEL (Rear panel) : TTL EXTERNAL DATA INPUT LEVEL (Rear panel) : TTL
3	Set the universal counter function switch to the A/B ratio and set the pulse pattern generator output level to TTL.
4	Read the value displayed on the universal counter.
5	Set-up the equipment as shown by the dotted line in Fig. 9-27.
6	Check that the value displayed on the universal counter is the same as the value read at step 4.
7	Set EXTERNAL CLOCK INPUT LEVEL, EXTERNAL DATA INPUT LEVEL, and the pulse pattern generator output level to ECL.

(continued)

Step	Procedure
8	Check that the values displayed on the universal counter at the solid-line setup and dotted-line setup are the same.
9	Set the pulse pattern generator clock frequency to 44.736 MHz.
10	Connect the DS-3 OUTPUT 1 connector to the oscilloscope CH1 connector and the CLOCK SYNC OUTPUT connector to the oscilloscope CH2 connector.
11	Check that the waveform shown in Fig. 9-28 is displayed on the oscilloscope.

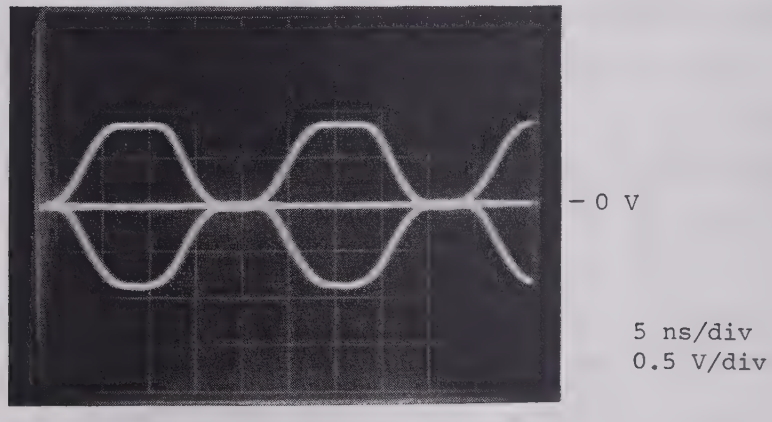


Fig. 9-28 External Data

9.4.11 Transmitter jitter modulation (OPT 01)

(1) Specifications

See Table 2-8.

(2) Setup (Use 75 Ω coaxial cable.)

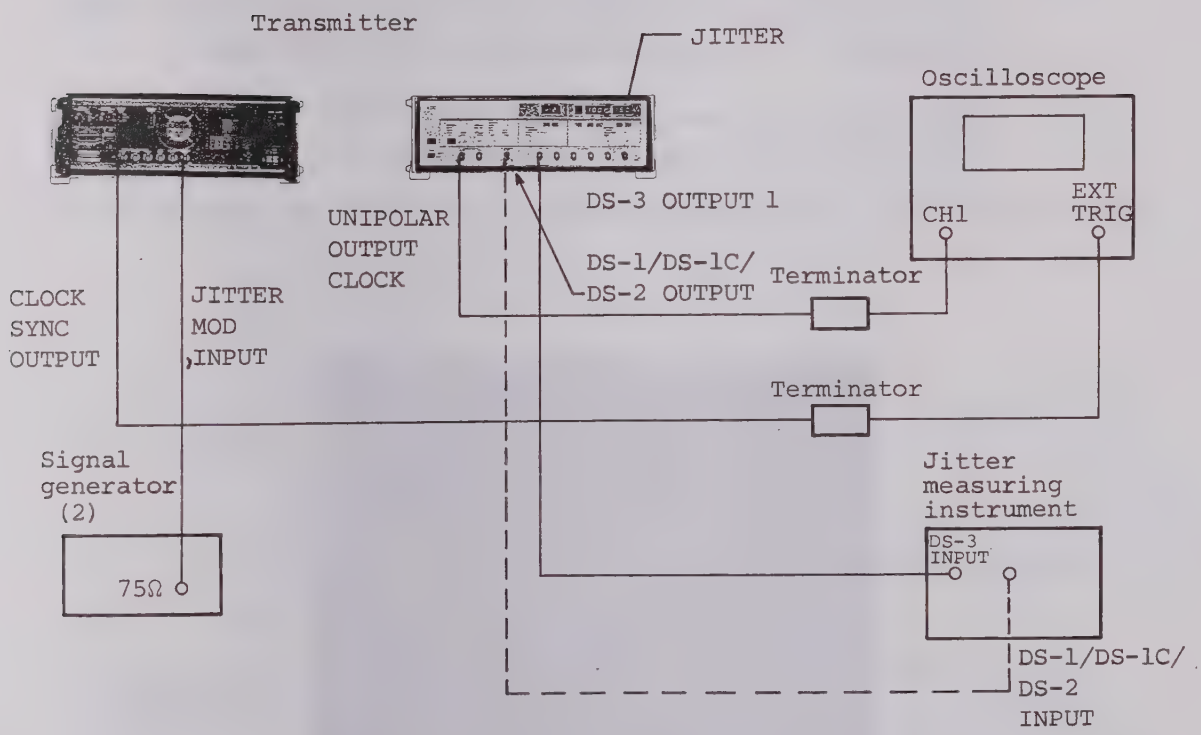


Fig. 9-29 Transmitter Jitter Modulation

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown by the solid line in Fig. 9-29.
2	Set [CLOCK] to DS-3 and [UNIPOLAR OUTPUT LEVEL] (rear panel) to +1/-1V.
3	Internal modulation check
	(a) Set the ME3401A transmitter as follows: JITTER : MANUAL FREQUENCY : 500 Hz AMPLITUDE : 0.00 UIp-p
	(b) Check that the waveform shown in Fig. 9-30 is displayed on the oscilloscope.
	(c) Set [DS-3 LEVEL] to HIGH and connect the DS-3 OUTPUT connector and jitter measuring instrument DS-3 INPUT connector.
	(d) Set JITTER AMPLITUDE of the ME3401A transmitter to obtain a reading of 0.50 UIp-p on the jitter measuring instrument.
	(e) Check that the ME3401A transmitter JITTER AMPLITUDE display indicates 0.5 ±0.125 UIp-p.
	(f) Set JITTER AMPLITUDE of the ME3401A transmitter to obtain a reading of 16.0 UIp-p on the jitter measuring instrument.
	(g) Check that the ME3401A transmitter JITTER AMPLITUDE display indicates 16.0 ±0.9 UIp-p.

(continued)

Step		Procedure
3 (cont.)	(h)	Switch [CLOCK] to DS-2, DS-1C, and DS-1 successively, and check that the ME3401A transmitter JITTER AMPLITUDE display is within ±5% ±0.1 UIp-p of the jitter measuring instrument reading.
4	External modulation check	
	(a)	Set the ME3401A transmitter as follows: JITTER : EXTERNAL
	(b)	Set the signal generator (2) frequency to 500 Hz and the output level to 0 V.
	(c)	Repeat steps (c) to (h) of the "Internal modulation check" item. However, set the signal generator (2) output level instead of JITTER AMPLITUDE of the ME3401A transmitter.

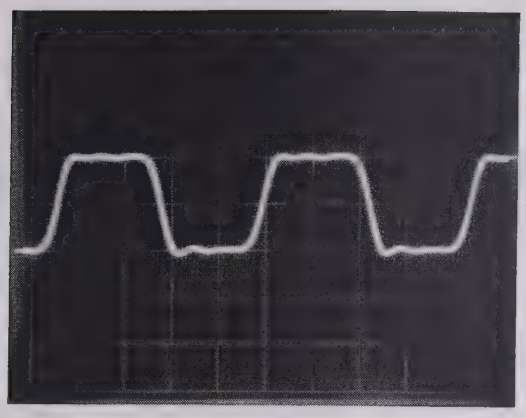


Fig. 9-30 Unmodulated Clock Output Waveform

9.5 Receiver Performance Check Procedure

9.5.1 DS-3 Input

(1) Specifications

Input level

DS-3 H/L : 0.91 V0-p, +6 to -26 dB

DSX-3 H/L: 0.91 V0-p, +6 to -26 dB and
450 ft of 728A cable or
0.91 V0-p, +6 to -6 dB and
450 to 900 ft of 728 A cable

(2) Setup (Use 75 Ω coaxial cable.)

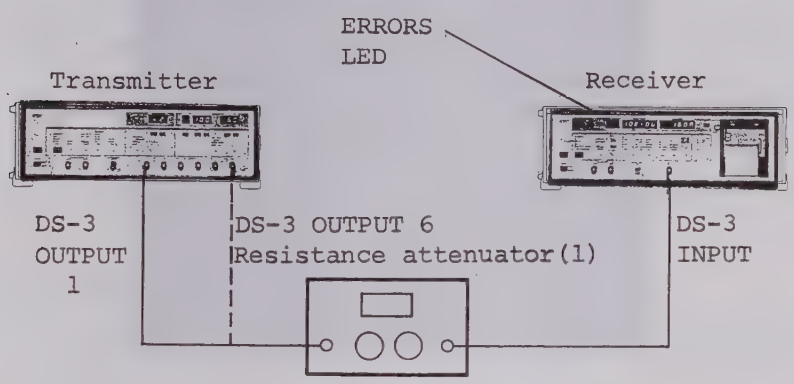


Fig. 9-31 DS-3 Input

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown by the solid line in Fig. 9-31.
2	Set the ME3401A transmitter as follows:
	CLOCK : DS-3
	FRAME : FRAMED
	PATTERN : PRBS
	ERROR ADDITION : OFF
	JITTER : OFF
	FUNCTION SWITCH A (Rear panel) : Set to all "0".

(continued)

Step	Procedure

3 Set the ME3401A receiver as follows:

FRAME : FRAMED

DEMUX : OFF

PATTERN : PRBS

ERROR : BIT

PAUSE/CONT : OFF

START/STOP : START

FUNCTION SWITCHes A, B, and C (Rear panel) : Set to all "0".

4 Check that the ERRORS LED does not light when the following settings are made:

	Transmitter DS-3 LEVEL	Receiver INPUT	Resistance attenuator	Setup
1.	HIGH	DS-3H/L	0 dB -26 dB	Solid line in Fig. 9-31.
2.	DSX-3	DSX-3H/L	0 dB -26 dB	Solid line in Fig. 9-31.
3.	LOW	DSX-3H/L	0 dB -6 dB	Dotted line in Fig. 9-31.

9.5.2 DS-1/DS-1C/DS-2 input

(1) Specifications

(a) DS-1 input

Input level: 3 V0-p, +2 to -6 dB (3.8 V0-p to 1.5 V0-p) and 0 to 655 ft of ABAM cable

(b) DS-1C input

Input level: 3 V0-p, +2 to -6 dB (3.8 V0-p to 1.5 V0-p) and 0 to 655 ft of ABAM cable

(c) DS-2 input

Input level: 2.1 V0-p, +2 to -6 dB (2.6 V0-p to 1.05 V0-p) and 0 to 1000 ft of ABAM cable

(2) Setup (Use balanced cable.)

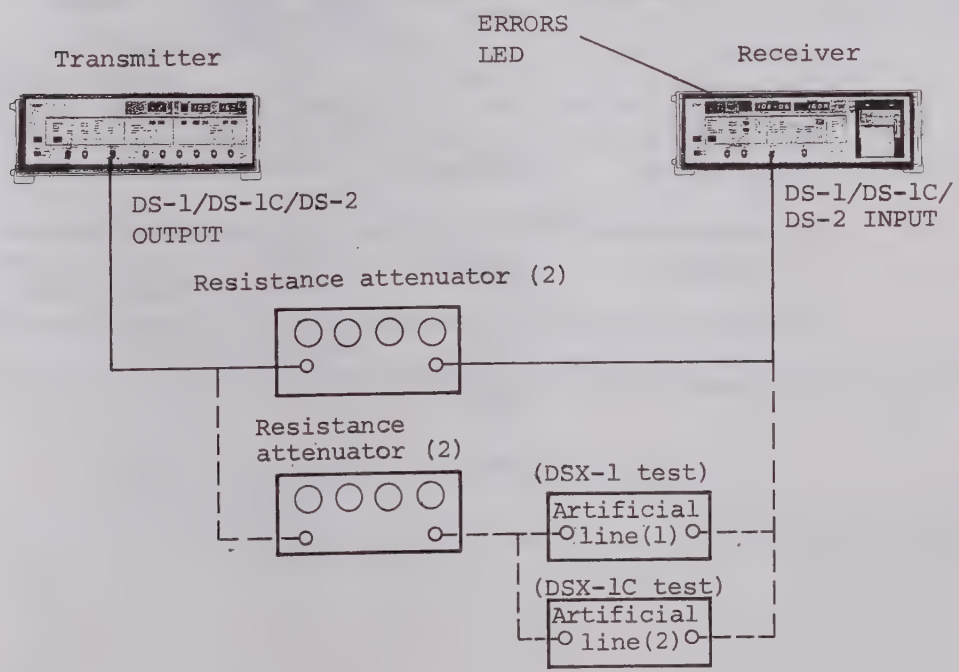


Fig. 9-32 DS-1/DS-1C/DS-2 Input

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown by the solid line in Fig. 9-32.
2	Set the ME3401A transmitter as follows:
	DS-1 CODE : AMI
	DS-1 FRAME : D4
	FRAME : FRAMED
	PATTERN : PRBS
	ERROR ADDITION : OFF
	JITTER : OFF
	FUNCTION SWITCH A (Rear panel) : Set to all "0".
3	Set the ME3401A receiver as follows:
	DS-1 CODE : AMI
	DS-1 FRAME : D4
	FRAME : FRAMED
	PATTERN : PRBS
	ERROR : BIT
	PAUSE/CONT : CONT
	START/STOP : START
	FUNCTION SWITCHes A, B, and C (Rear panel) : Set to all "0".

(continued)

Step	Procedure

4 Check that the ERRORS LED does not light when the following settings are made:

	Transmitter		Receiver INPUT	Resistance attenuator	Artifucal line	Setup
	CLOCK	FUNCTION SWITCH A				
1.	DS-2	A5=1	DS-2	0 dB, -6 dB	_____	Solid line in Fig. 9-32.
2.	DS-2	A5=0	DS-2	0 dB, -6 dB	_____	Solid line in Fig. 9-32.
3.	DS-1C	_____	DS-1C	0 dB, -6 dB	_____	Solid line in Fig. 9-32.
4.	DS-1C	_____	DS-1C	0 dB, -6 dB	Artifical line (2)	Dotted line in Fig. 9-32.
5.	DS-1	_____	DS-1	0 dB, -6 dB	_____	Dotted line in Fig. 9-32.
6.	DS-1	_____	DS-1	0 dB, -6 dB	Artifical line (1)	Dotted line in Fig. 9-32.

9.5.3 Unipolar input

(1) Specifications

Input level : TTL, +1/-1 V, ECL

(2) Setup

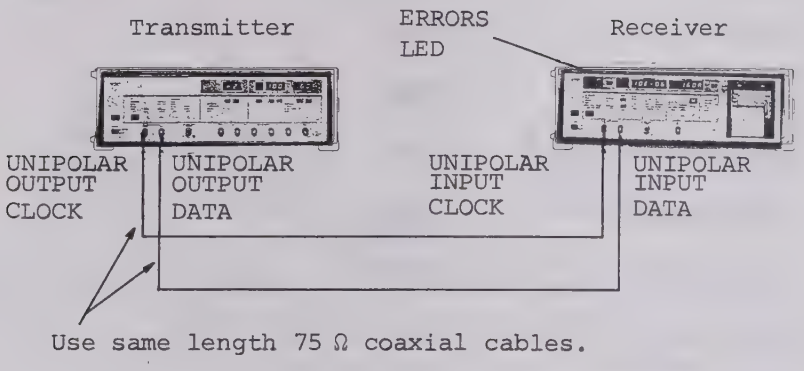


Fig. 9-33 Unipolar Output

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-33.
2	Set the ME3401A transmitter as follows:
	CLOCK : DS-3
	FRAME : FRAMED
	PATTERN : PRBS
	ERROR ADDITION : OFF
	JITTER : OFF
	FUNCTION SWITCH A (Rear panel) : Set to all "0".

(continued)

Step	Procedure
3	Set the ME3401A receiver as follows:
	INPUT : UNIPOLAR
	FRAME : FRAMED
	DEMUX : OFF
	PATTERN : PRBS
	ERROR : BIT
	PAUSE/CONT : CONT
	START/STOP : START
	FUNCTION SWITCHes A, B, and C (Rear panel) : Set to all "0".
4	Set [UNIPOLAR OUTPUT LEVEL] of the ME3401A transmitter and [UNIPOLAR INPUT LEVEL] of the ME3401A receiver to TTL, +1/-1V, and ECL, successively.
5	Check that the ERRORS LED does not light when TTL, +1/-1V, or ECL is set.

9.5.4 Pattern and frame

(1) Specifications

Pattern : PRBS, 1111, 1100, 1010, 1000

Frame : DS-1, DS-1C, DS-2, DS-3

(2) Setup

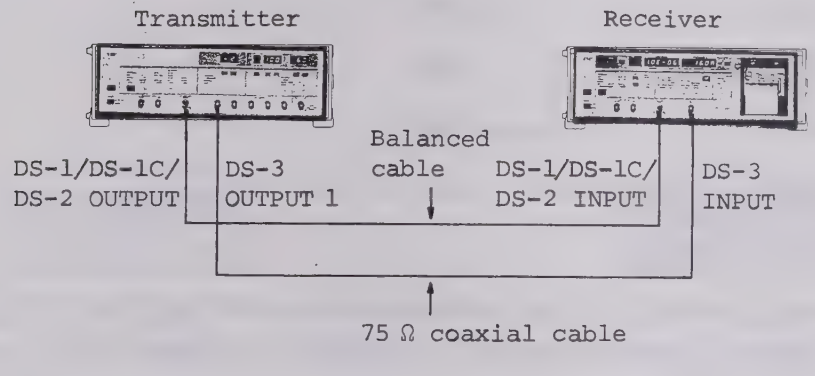


Fig. 9-34 Pattern and Frame

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-34.
2	Set the ME3401A transmitter as follows:
	FRAME : FRAMED
	DS-3 LEVEL : DSX-3
	ERROR ADDITION : OFF
	JITTER : OFF
	FUNCTION SWITCH A (Rear panel) : Set to all "0".
	DS-1 CODE : AMI

(continued)

Step	Procedure
3	Set the ME3401A receiver as follows: FRAME : FRAMED DEMUX : OFF DS-1 CODE : AMI ERROR : BIT PAUSE/CONT : CONT START/STOP ; START FUNCTION SWITCHes A, B, and C (Rear panel) : Set to all "0".
4	Set [CLOCK] of the ME3401A transmitter to DS-3 and [INPUT] of the ME3401A receiver to DSX-3H/L.
5	Switch [PATTERN] of the ME3401A transmitter and ME3401A receiver to PRBS, 1111, 1100, 1010, and 1000 successively and check that the ERRORS LED does not light at any pattern.
6	Set [CLOCK] and [INPUT] of the ME3401A transmitter and ME3401A receiver to DS-2, DS-1C, and DS-1 succesively.
7	Repeat step 5 at each clock.

9.5.5 Measurement

(1) Specifications

Measurement items : Error rate
Error count
Error seconds
% Error free seconds
Threshold ES

(2) Setup

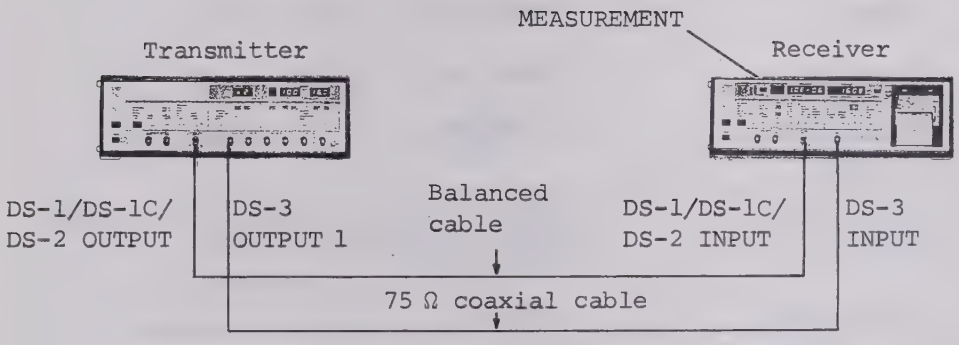


Fig. 9-35 Measurement

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-35.
2	Set the ME3401A transmitter as follows:
	CLOCK : DS-3
	FRAME : FRAMED
	PATTERN : PRBS

(continued)

Step	Procedure	
2 (cont.)	DS-3 LEVEL	: DSX-3
	ERROR ADDITION	: SINGLE
	JITTER	: OFF
	FUNCTION SWITCH A (Rear panel)	: Set to all "0".
4	Set the ME3401A receiver as follows:	
	INPUT	: DSX-3 H/L
	FRAME	: FRAMED
	PATTERN	: PRBS
	MEASUREMENT DISPLAY	: ER RATE
	TIME DISPLAY	: TIMED (Set the measuring time to 10 s.)
	TIME MODE	: SINGLE
	PAUSE/CONT	: CONT
	ERROR	: BIT
	JITTER	: OFF
	FUNCTION SWITCHes A, B, anc C (Rear panel)	: Set to all "0".
5	Press [START/STOP] of the ME3401A receiver and after the GATING LED lights, press [ERROR ADDITION SINGLE] of the ME3401A transmitter once.	
6	Check that the measured result becomes as shown in Fig. 9-10 after 10 seconds.	

(continued)

Step	Procedure
7	Set the ME3401A transmitter as follows: CLOCK : DS-1 DS-1 CODE : AMI DS-1 FRAME : ESF
8	Set the ME3401A receiver as follows: INPUT : DS-1 DS-1 CODE : AMI DS-1 FRAME : ESF ERROR : CRC-6
9	Repeat step 5 and check that the CRC-6 measured result becomes as shown in Table 9-10 after 10 seconds.

Table 9-10 Measurement

ERROR	DISPLAY				
	ER RATE	ER COUNT	ES	%EFS	TH ES
BIT	2.0×10^{-9} to 2.4×10^{-9}	1	1	900000	0
PARITY	2.0×10^{-9} to 2.4×10^{-9}	1	1	900000	0
FRAME	0.0×10^{-7}	0	0	100	0
BIP V	0.0×10^{-9}	0	0	100	0
CRC-6	6.4×10^{-8} to 6.6×10^{-8}	1	1	900000	0

9.5.6 STATUS LED

(1) Specification

Lights at alarm or error detection

(2) Setup

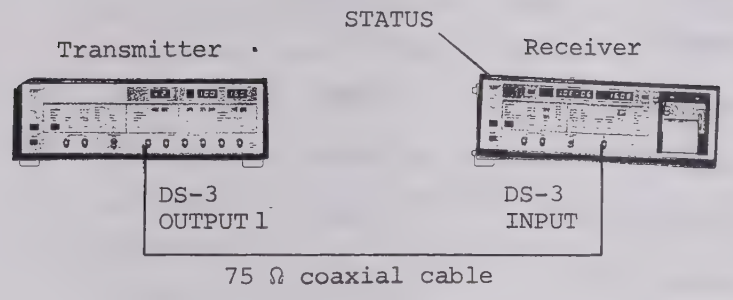


Fig. 9-36 STATUS LED

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-36.
2	Set the ME3401A transmitter as follows:
	CLOCK : DS-3
	FRAME : FRAMED
	PATTERN : PRBS
	DS-3 LEVEL : DSX-3
	ERROR ADDITION : OFF
	JITTER MODULATION : OFF
	FUNCTION SWITCH A (Rear panel) : Set to all "0".

(continued)

Step	Procedure
3	Set the ME3401A receiver as follows: INPUT : DSX-3 H/L FRAME : FRAMED DEMUX : OFF PATTERN : PRBS ERROR : BIT PAUSE/CONT : CONT START/STOP : START FUNCTION SWITCHes A, B, and C (Rear panel) : Set to all "0".
4	Check that all the STATUS LEDs (red LED) go off. If the HISTORY LED (orange LED) lights, turn it off by pressing [HISTORY PRESET].
5	AC POWER FAIL LED check (a) Disconnect the ME3401A receiver AC power cord from the AC outlet, then reconnect it. (b) Check that the AC POWER FAIL LED (orange LED) lights. (c) Press [HISTORY RESET] and check that the LED goes off.

(continued)

Step	Procedure
6	SIGNAL LOSS LED check
	(a) Disconnect the cable connecting the ME3401A transmitter DS-3 OUTPUT connector to the ME3401A receiver DS-3 INPUT connector and check that only the SIGNAL LOSS LEDs (red LED and orange LED) light.
	(b) Connect the ME3401A transmitter DS-3 OUTPUT connector to the ME3401A receiver DS-3 INPUT connector and check that only the SIGNAL LOSS organge LED lights.
	(c) Press [HISTORY RESET] and check that the LED goes off.
7	FRAME LOSS LED check
	(a) Set [FRAME] of the ME3401A transmitter to UNFRAMED and check that only the FRAME LOSS LEDs (red LED and organge LED) light.
	(b) Set [FRAME] of the ME3401A transmitter to FRAMED and check that only the FRAME LOSS orange LED lights.
	(c) Press [HISTORY RESET] and check that the LED goes off.
8	PATT SY LOSS and BLUE SIGNAL LED check
	(a) Set [PATTERN] of the ME3401A transmitter to 1010 and check that the PATT SY LOSS LEDs (red LED and orange LED) and BLUE SIGNAL LEDs (red LED and orange LED) light.

(continued)

Step		Procedure
8 (cont.)	(b)	SEt [PATTERN] of the ME3401A transmitter to PRBS and check that only the PATT SY LOSS and BLUE SIGNAL orange LEDs light.
	(c)	Press [HISTORY RESET] and check that the LEDs go off.

9.5.7 Printer (OPT 11)

(1) Specifications

Prints measured result

(2) Setup

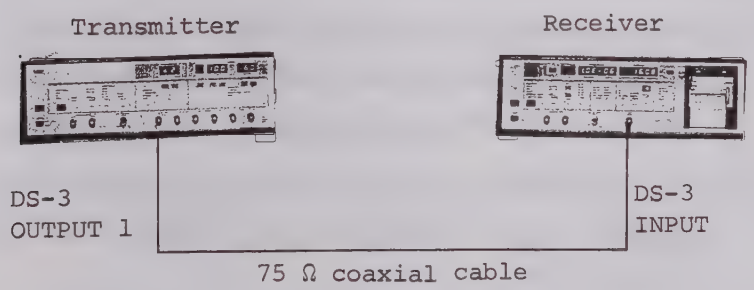


Fig. 9-37 Printer

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-37.
2	Set the ME3401A transmitter as follows:
	CLOCK : DS-3
	FRAME : FRAMED
	PATTERN : PRBS
	DS-3 LEVEL : DSX-3
	ERROR ADDITION : SINGLE
	JITTER : OFF
	FUNCTION SWITCH A (Rear panel) : Set to all "0".
3	Set the ME3401A receiver as follows:
	INPUT : DSX-3 H/L
	FRAME : FRAMED
	DEMUX : OFF
	PATTERN : PRBS
	TIME DISPLAY : TIMED (Set the measurint time to 10 s.)
	PAUSE/CONT : CONT
	PRINT : ON
	FUNCTION SWITCHes A and C : Set to all "0".
	FUCTION SWITCH B : Set B2 and B3 to "1", and B1 and B4 to B8 to "0".

Step	Procedure

4 Press [START/STOP] of the ME3401A receiver and after the GATING LED lights, press [ERROR ADDITION SINGLE] of the ME3401A transmitter once.

5 Check that the following data is printed after 10 seconds:

```
**********************
START MAR01/18:31:02
END   MAR01/18:31:12
ELAPSED  00/00:00:10
* MEAS DATA (DS-3) *
        BIT     BIP V
 ER 2.3E-09 0.0E-09
 EC       1        0
 ES       1        0
%EFS 90.0000     100
     PARITY   FRAME
 ER 2.2E-09 0.0E-07
 EC       1        0
 ES       1        0
%EFS 90.0000     100
*  ALARM SECONDS    *
 POW F  0s SIG L  0s
 FRM L  0s BLUE   0s
 PAT L  0s XBIT   0s
*   THRESHOLD ES    *
           BIT  BIP V
 >E-3        0       0
 >E-4        0       0
 >E-5        0       0
 >E-6        0       0
 >E-7        0       0
        PARITY  FRAME
 >E-3        0       0
 >E-4        0       0
 >E-5        0       0
 >E-6        0       0
 >E-7        0       0
* ERROR PERFORMANCE*
 ES (BIT)   10.0000%
 EFS        90.0000%
 SES(>E-3)   0.0000%
 DM (>E-6)   0.0000%
 US          0.0000%
 CSES              0
**********************
```

9.5.8 Receiver jitter measurement (OPT 02)

(1) Specifications

See Table 2-9.

(2) Setup

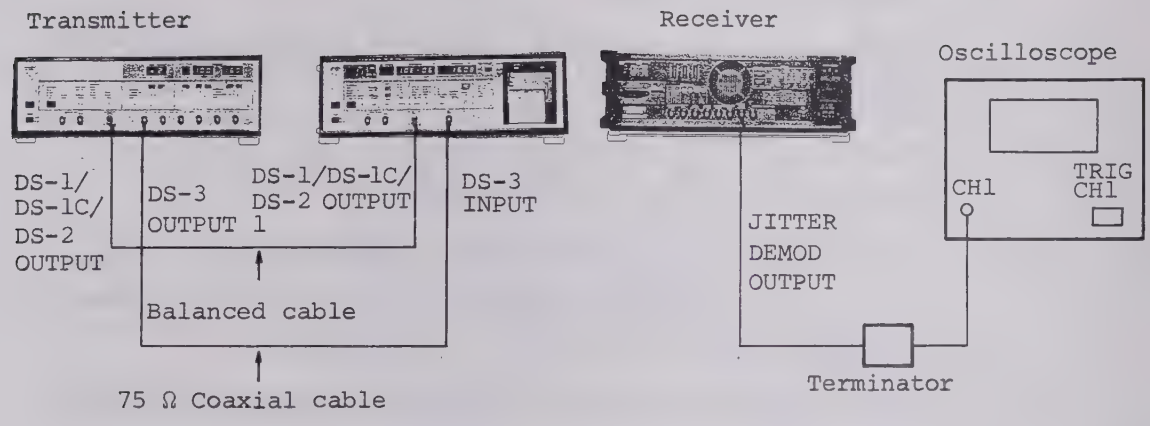


Fig. 9-38 Receiver Jitter Measurement

(3) Procedure

Step	Procedure
1	Set-up the equipment as shown in Fig. 9-38.
2	Set the ME3401A transmitter as follows: CLOCK : DS-3 DS-3 LEVEL : DSX-3 JITTER : MANUAL FREQUENCY : 500 Hz AMPLITUDE : 4.0 UIp-p

(continued)

Step	Procedure
3	Set the ME3401A receiver as follows: INPUT : DSX-3 H/L JITTER : ON (FILTER OFF) TIME/JITTER : UIp-p
4	Check that the ME3401A receiver JITTER AMPLITUDE display indicates 4.0 ±0.3 UIp-p.
5	Check that the waveform shown in Fig. 9-39 is displayed on the oscilloscope.
6	Set [CLOCK] of the ME3401A transmitter to DS-2, DS-1C, and DS-1 and [INPUT] of the ME3401A receiver to DS-2, DS-1C, and DS-1, successively.
7	Check that the ME3401A receiver JITTER AMPLITUDE display indicates 4.0 ±0.3 UIp-p and the waveform shown in Fig. 9-39 is displayed on the oscilloscope at each clock.

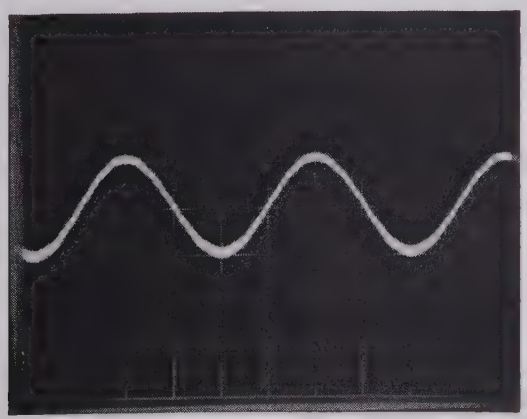


Fig. 9-39 DEMOD OUTPUT

APPENDIX A

OPTION 03

This option is briefly described below:

1. General

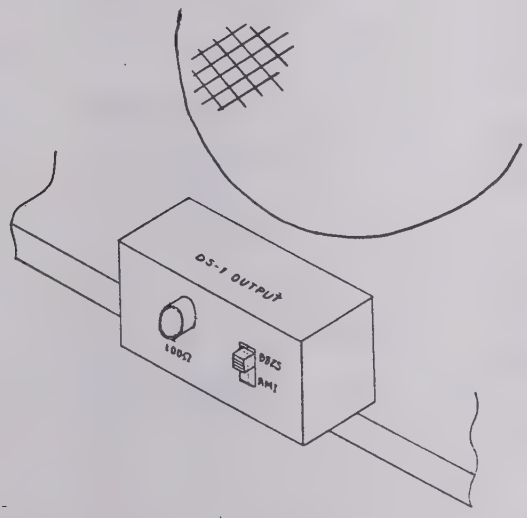
With option 03, Demultiplexed DS-1 OUTPUT of the ME3401A receiver is changed from unipolar to bipolar.

AMI or B8ZS can be used for the code.

2. Specifications

Frequency	Nominal 1.544 Mb/s	Corresponds with Demultiplexed DS-1 bit rate
Code	AMI, B8ZS	
Level	3 Vo-p	
Load	100 Ω balanced	
Connector	Accepts Weco 310 plug	

3. Receiver Rear Panel



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